Town of Seabrook, NH

Natural Hazard Mitigation Plan Update 2018

Approved by the

Seabrook Board of Selectmen

_____

Prepared with the Assistance of the

ROCKINGHAM PLANNING COMMISSION

This project was partially funded by

NH Homeland Security and Emergency Management

Certificate of Adoption

WHEREAS, the Town of Exeter received funding from the NH Office of Homeland Security and Emergency Management under a Pre-Disaster Mitigation Grant and assistance from Rockingham Planning Commission in the preparation of the Seabrook Hazard Mitigation Plan Update 2018; and

WHEREAS, several public planning meetings were held between December 2017 and May 2018 regarding the development and review of the Seabrook Hazard Mitigation Plan Update 2018; and

WHEREAS, the Seabrook Hazard Mitigation Plan Update 2018 contains several potential future projects to mitigate hazard damage in the Town of Seabrook; and

WHEREAS, a duly-noticed public hearing was held by the Seabrook Board of Selectmen on _____ to formally approve and adopt the Seabrook Hazard Mitigation Plan Update 2018.

NOW, THEREFORE BE IT RESOLVED that the Seabrook Board of Selectmen:

- The Plan is hereby adopted as the official plan of the Town of Seabrook:
- The respective individuals identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them;
- Future revisions and Plan maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as part of this resolution for a period of five (5) years from the date of this resolution;
- An annual report of the progress of the implementation elements of the Plan shall be presented to the Board of Selectmen by the Town's Emergency Management Director or Town Manager.

NOW, THEREFORE BE IT RESOLVED that the Seabrook Board of Selectmen adopts the Seabrook Hazard Mitigation Plan Update 2018.

IN WITNESS THEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Seabrook on this _____ day of _____.

_____ Selectman

_____ Selectman

_____ Selectman

ATTEST

_____

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EXECUTIVE SUMMARY

The Seabrook Hazard Mitigation Plan Update 2018 (herein also referred to as the Plan) was compiled to assist the Town of Seabrook in reducing and mitigating future losses from natural hazard events. The Plan was developed by the Rockingham Planning Commission and participants from the Town of Seabrook Natural Hazard Mitigation Committee and contains the tools necessary to identify specific hazards, and aspects of existing and future mitigation efforts.

The following natural hazards are addressed:

- Flooding
- Hurricane-High Wind Event
- Severe Winter Weather
- Wildfire
- Earthquake
- Sea Level Rise, Coastal Storms and Storm Surge
- Drought
- Extreme Temperatures

The list of critical facilities includes:

- Municipal facilities
- Communication facilities
- Fire stations and law enforcement facilities
- Schools
- Shelters
- Evacuation routes
- Vulnerable Populations

The Seabrook Hazard Mitigation Plan Update 2018 is considered a work in progress and should be revisited annually to assess whether the existing and suggested mitigation strategies are successful. Copies have been distributed to the Town Hall and the Emergency Operations Center. A copy of the Plan is also on file at The Rockingham Planning Commission, New Hampshire Homeland Security and Emergency Management (NHHSEM) and the Federal Emergency Management Agency (FEMA). This Document was approved by both agencies prior to adoption at the local level.

CHAPTER I – INTRODUCTION

Background

The New Hampshire Homeland Security and Emergency Management (NHHSEM) has a goal for all communities within the State of New Hampshire to establish local hazard mitigation plans to reduce and mitigate future losses from natural hazard events. The NHHSEM outlined a process whereby communities throughout the State may be eligible for grants and other assistance upon completion of a local hazard mitigation plan. A handbook entitled Hazard Mitigation Planning for New Hampshire Communities was created by NHHSEM to assist communities in developing local plans. The State's Regional Planning Commissions are charged with providing assistance to selected communities to develop local plans.

The Seabrook Hazard Mitigation Plan Update 2018 was prepared by participants from the Town of Seabrook Hazard Mitigation Team with the assistance and professional services of the Rockingham Planning Commission (RPC) under contract with the New Hampshire Homeland Security and Emergency Management operating under the guidance of Section 44 CFR 201.6. The Plan serves as a strategic planning tool for use by the Town of Seabrook in its efforts to identify and mitigate the future impacts of natural and/or man-made hazard events.

Methodology

The Rockingham Planning Commission (RPC) organized the first meeting with emergency management officials from the Town of Seabrook on November 28, 2017 to begin the initial planning stages of the Plan Update (primarily step 1). This meeting precipitated the development of the Natural Hazards Mitigation Committee (herein after, the Committee). RPC and participants from the Town developed the content of the Plan using the ten-step process set forth in the Hazard Mitigation Planning for New Hampshire Communities. The following is a summary of the ten-step process conducted to compile the Plan. Publicly noticed work session meetings were also held on November 30, 2017, January 9, 2018, February 22, 2018, March 23, 2018, April 19, 2018 (add other dates here). The Town of Seabrook's Emergency Management Director and staff from the Rockingham Planning Commission solicited input on the Plan from local officials, abutting communities, and residents throughout the Plan development process.

The Town's 2013 Plan served as the starting point for discussion on hazards impacting the Town, as well as discussions on mitigation strategies. The 2013 Plan served as a reference for local land use regulations and policies, development of the Town's Capital Improvement Plan and department budgets, and has been referenced in several reports, including the 2016 NH Coastal Risks and Hazards Commission Final Report, the RPC's 2015 Regional Master Plan, the Town's 2017 Sea Level Rise and Coastal Storm Surge Vulnerability Assessment and other adaptation planning initiatives.

Step 1- Form the Committee

The Emergency Management Director invited Department Heads from all the Town's departments to participate in the Plan Update process. As a result, the Plan Update Committee included the Emergency Management Director, Town Manager, Fire Chief, Deputy Fire Chief, Deputy Police Chief, Fire and Emergency Management Secretary,

Public Works Manager, Sewer Superintendent, Town Planner, Building Inspector/Health Officer, and Harbor Master. Public notices about the Plan Update process were posted on the Town website and the Rockingham Planning Commission's website and monthly newsletter. All meetings were open to the public, and RPC staff kept municipalities in the region informed of the Plan Update. In addition, RPC staff working in the region kept local officials in these communities informed of the update to Seabrook's Plan Update and the opportunity to comment on regional mitigation strategies.

Step 2 – Map the Hazards

Participants in the Committee identified areas where damage from historic natural disasters have occurred and areas where critical man-made facilities and other features may be at risk in the future for loss of life, property damage, environmental pollution and other risk factors. RPC generated a set of base maps with GIS (Geographic Information Systems) that were used in the process of identifying past and future hazards.

Step 3 – Identify Critical Facilities and Areas of Concern

Participants in the Committee identified facilities and areas that were considered to be important to the Town for emergency management purposes, for provision of utilities and community services, evacuation routes, and for recreational, historical, cultural and social value. These facilities and areas are identified on the Critical Facilities Map.

Step 4 – Identify Existing Mitigation Strategies

After collecting detailed information on each critical facility in Seabrook, the Committee and RPC staff identified existing Town mitigation strategies relative to flooding, hurricane and wind events, severe winter weather, wildfire, earthquake, sea level rise, coastal storms and storm surge, as well as drought and extreme temperatures. This process involved reviewing the Town's 2013 Hazard Mitigation Plan, the Town's Master Plan and Capital Improvements Program, Zoning Ordinance, Subdivision Regulations, Site Plan Review Regulations, 2017 Vulnerability Assessment, Emergency Operations Plan, and the Town's participation in the National Flood Insurance Program (NFIP).

Step 5 – Identify the Gaps in Existing Mitigation Strategies

The existing strategies were then reviewed by the RPC and the Committee for coverage and effectiveness, as well as the need for improvement.

Step 6 – Identify Potential Mitigation Strategies

A list was developed of additional hazard mitigation actions and strategies for the Town of Seabrook. The existing Hazard Mitigation Plans of Portsmouth, North Hampton and

Plaistow were just a few towns that were utilized to identify new mitigation strategies as well as the town Master Plan, Emergency Operations Plan, and Vulnerability Assessment.

Step 7 – Prioritize and Develop the Action Plan

The proposed hazard mitigation actions and strategies were reviewed, and each strategy was rated (good, average, or poor) for its effectiveness according to several factors (*e.g.*, technical and administrative applicability, political and social acceptability, legal authority, environmental impact, financial feasibility). Each factor was then scored, and all scores were totaled for each strategy. Strategies were ranked by overall score for preliminary prioritization then reviewed again under Step 8.

Step 8 - Determine Priorities

The preliminary prioritization list was reviewed to make changes and determine a final prioritization for new hazard mitigation actions and existing protection strategy improvements identified in previous steps. RPC also presented recommendations to be reviewed and prioritized by the Plan Update Committee.

Step 9 - Develop Implementation Strategy

Using the chart provided under Step 9 in the handbook, an implementation strategy was created which included person(s) responsible for implementation (who), a timeline for completion (when), and a funding source and/or technical assistance source (how) for each identified hazard mitigation actions. Also, when the Master Plan or the Seabrook Capital Improvement Plan (CIP) is updated the Seabrook Hazard Mitigation Plan Update 2018 shall be consulted to determine if strategies or actions suggested in the Plan can be incorporated into the Town's future land use recommendations and or capital expenditures.

Step 10 - Adopt and Monitor the *Plan*

RPC staff compiled the results of Steps 1 to 9 in a draft document. This draft Plan was reviewed by members of the Committee and by staff members at the RPC. RPC staff compiled the results of Steps 1 to 8 in a draft document. This draft Plan was reviewed by members of the Committee and by staff members at the RPC. The draft Plan was also placed on the RPC website for review by the public, neighboring communities, agencies, businesses, and other interested parties to review and make comments via email. A duly noticed public meeting was held by the Seabrook Board of Selectmen on (date to be added). The meeting allowed the community and neighboring towns to provide comments and suggestions for the Plan in person, prior to the document being finalized. After the meeting it was decided the plan be posted on the town website for further public comment and another Selectmen's hearing was held on (date to be added) to review, if any, comments from the town and surrounding areas. It also allowed board and committee members to review other planning documents in town such as the

Master Plan and CIP to consider and incorporate pertinent information that may be included within the Hazard Mitigation Plan. The draft was revised to incorporate comment from the Selectmen, Planning Board and general public and then submitted to the NH HSEM and FEMA Region I for their review and comments. Any changes required by NH HSEM and FEMA were made and a revised draft document was then submitted to the Seabrook Board of Selectmen for their final review. A public hearing was then held by the Seabrook Board of Selectmen on (date to be added), this public hearing the Plan Update was approved and adopted by the Board of Selectman. The formal letter of approval from FEMA Region 1 can be found in the Appendix.

Hazard Mitigation Goals and Objectives of the Town of Seabrook, New Hampshire

The Town of Seabrook sets forth the following hazard mitigation goals and objectives:

- Reduce or avoid long-term vulnerabilities posed by natural hazards impacting Seabrook, including the impacts from flooding, hurricanes and high wind events, severe winter weather, wildfire and conflagration, earthquakes, drought, extreme temperatures, and climate change, including sea-level rise and coastal storm surge.

- Improve upon the protection of the Town of Seabrook's general population, the citizens of the State and guests, from all natural and man-made hazards.

- Reduce the potential impact of natural and man-made disasters on Seabrook and the State's Critical Support Services.

- Reduce the potential impact of natural and man-made disasters on Seabrook's Critical Facilities in the State.

- Reduce the potential impact of natural and man-made disaster on Seabrook's and the State's infrastructure.
- Improve Seabrook's Emergency Preparedness.
- Improve Seabrook's Disaster Response and Recovery Capability.
- Reduce the potential impact of natural and man-made disasters on private property in Seabrook.
- Reduce the potential impact of natural and man-made disasters on Seabrook's and the State's economy.
- Reduce the potential impact of natural and man-made disasters on Seabrook's and the State's natural environment.
- Reduce Seabrook's and the State's liability with respect to natural and man-made hazards generally.
- Reduce the potential impact of natural and man-made disasters on Seabrook's and the State's specific historic treasures and interests as well as other tangible and intangible characteristics that add to the quality of life to the citizens and guests of the State and the Town.
- Identify, introduce and implement cost effective Hazard Mitigation measures so as to accomplish Seabrook's and the States' goals and objectives in order to raise the awareness and acceptance of hazard mitigation planning.

Through the adoption of this Plan the Town of Seabrook concurs and adopts these goals and objectives.

Acknowledgements

The Seabrook Board of Selectmen extends special thanks to those that assisted in the development of this Plan Update by serving as member of Natural Hazards Mitigation Committee:

Joseph Titone, Emergency Management Director, Town of Seabrook
William Manzi, Town Manager, Town of Seabrook
William Edwards, Fire Chief, Town of Seabrook
Lawrence Perkins, Deputy Fire Chief, Town of Seabrook
Brett Walker, Deputy Police Chief, Town of Seabrook
Kelly McDonald, Fire and Emergency Management Secretary, Town of Seabrook
Tom Morgan, Town Planner, Town of Seabrook
John Starkey, Public Works Manager, Town of Seabrook
Philippe Maltais, Sewer Superintendent, Town of Seabrook
Curtis Slayton, Water Superintendent, Town of Seabrook
Steve Zalewski, Building Inspector/Health Officer, Town of Seabrook
Domenic Pike, Harbor Master

The Seabrook Board of Selectmen offers thanks to the **NHHSEM** which provided funding and assistance with the development of this Plan Update.

In addition, thanks are extended to the staff of the **Rockingham Planning Commission** for professional services, process facilitation and preparation of this document.

CHAPTER II – COMMUNITY PROFILE

Seabrook is located in the Southeastern corner of New Hampshire in Rockingham County. The Town borders the New Hampshire towns of Hampton, Hampton Falls, Kensington and South Hampton. To the south, Seabrook borders on the Massachusetts Town of Salisbury, in Essex County. Seabrook had a population of 8,693 as of the 2010 census. Seabrook was settled in 1638 and incorporated as a separate town in 1768.

The Town of Seabrook is approximately 5,978 acres (9.34 square miles), with 318 acres covered in open water. The town is relatively flat with 95% of the land area under 60' above sea level. The highest point is Grape Hill at 220' above sea level. The committee reviewed the maps below and all figures presented herein are considered by the committee to be accurate for this plan update.

Figure 1: Location Map of Seabrook, New Hampshire

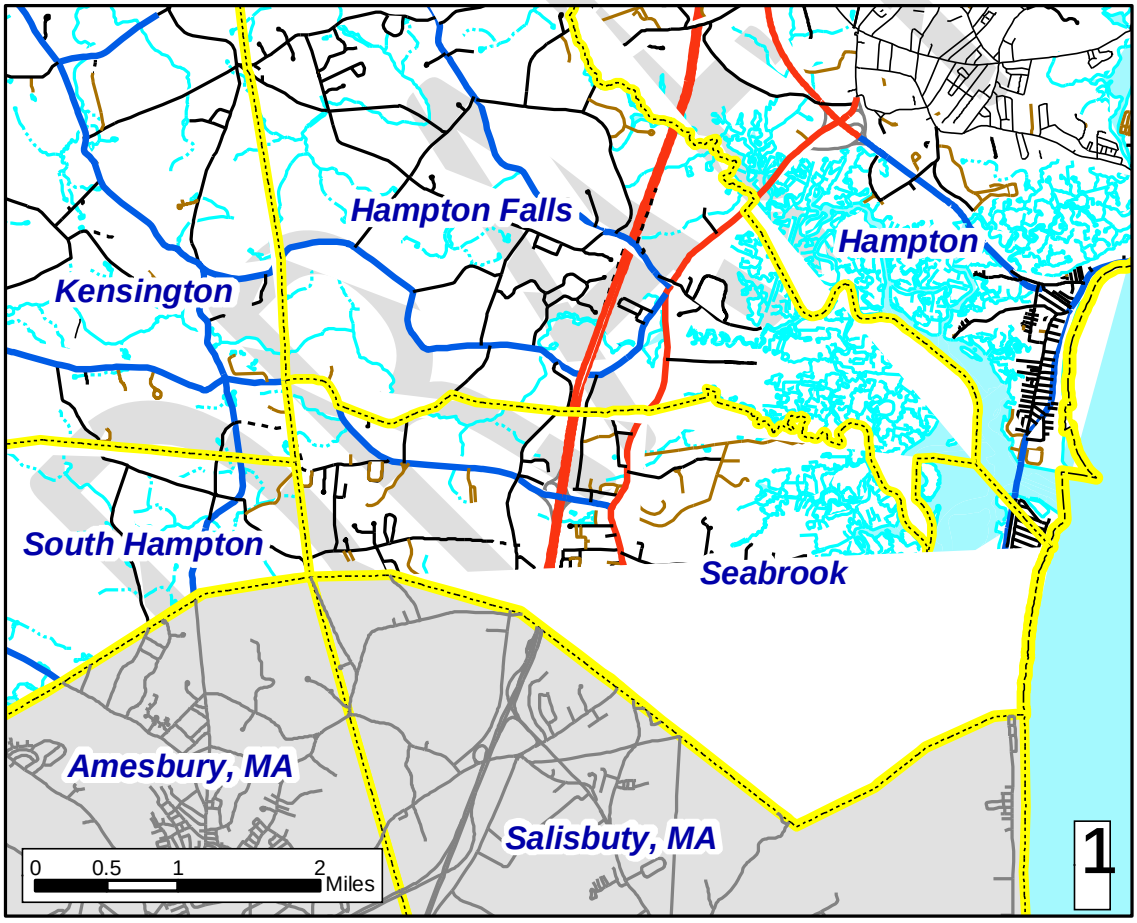
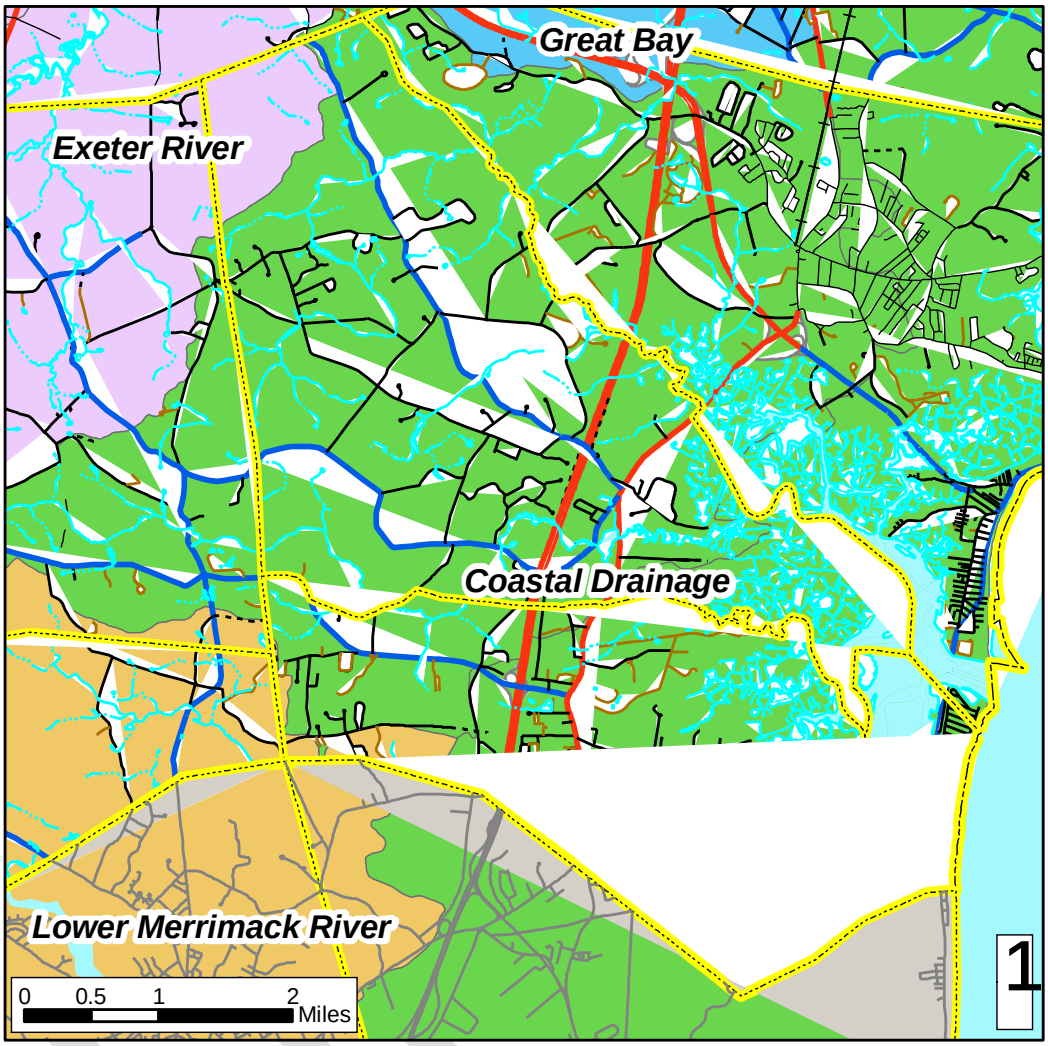
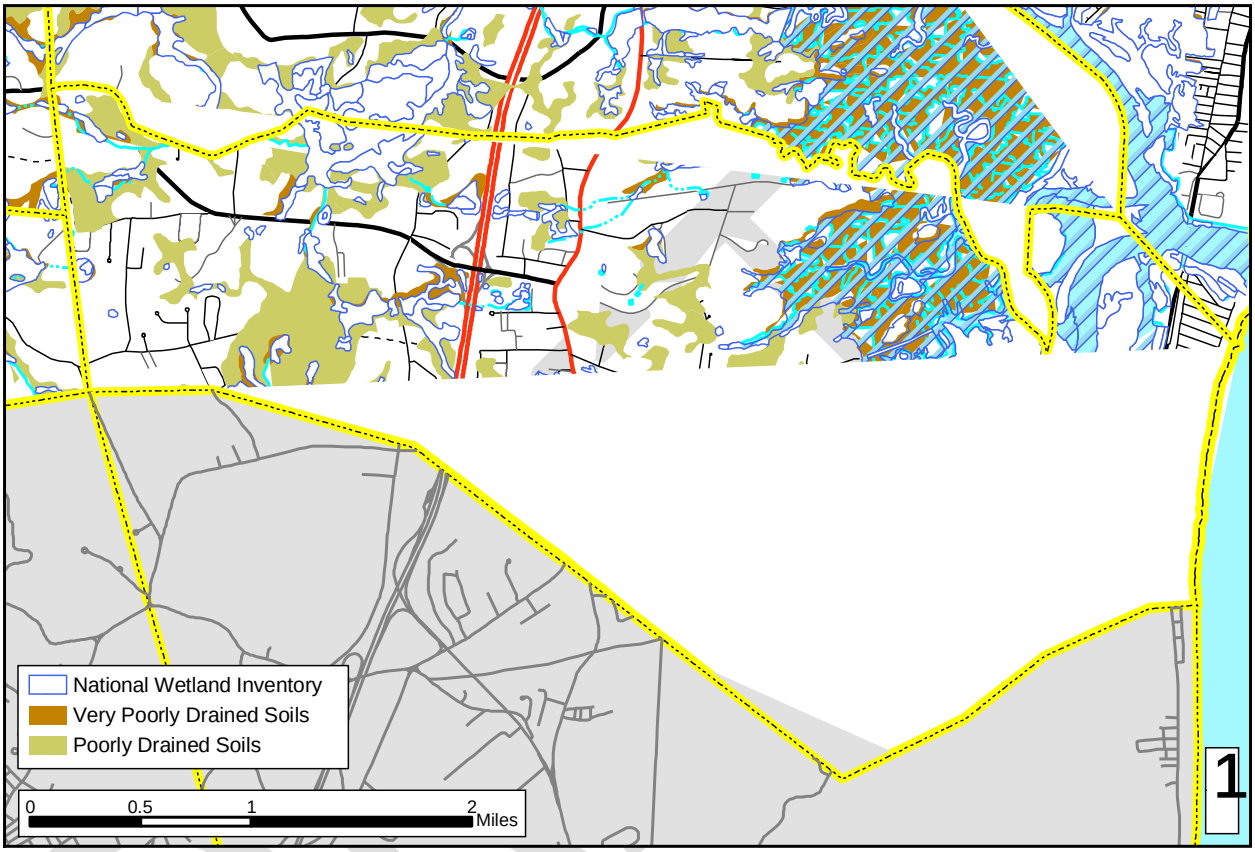


Figure 2: Watershed Map of Seabrook, New Hampshire.



Seabrook is part of two major watersheds, the Coastal Drainage watershed and the Lower Merrimack River water shed, as can be seen below in Figure 2. These two major drainage basins can be broken down in to six sub-watersheds. The flow of surface waters within these watersheds is generally west to east. The Watersheds of Gove Brook – Hampton Falls River, Brown's River, Rocky Brook – Hunt's Island Creek, and Cain's Brook – Mill Creek all drain from the east to the west and into the Blackwater River – Hampton Harbor watershed which is part of the larger Coastal Drainage Basin. The only watershed within Seabrook that doesn't drain into the Blackwater River – Hampton Harbor is the Lucy Brook – Back River, which drains into the Lower Merrimack River Basin. The Lucy Brook – Back River only covers 179 acres, or 3% of town.

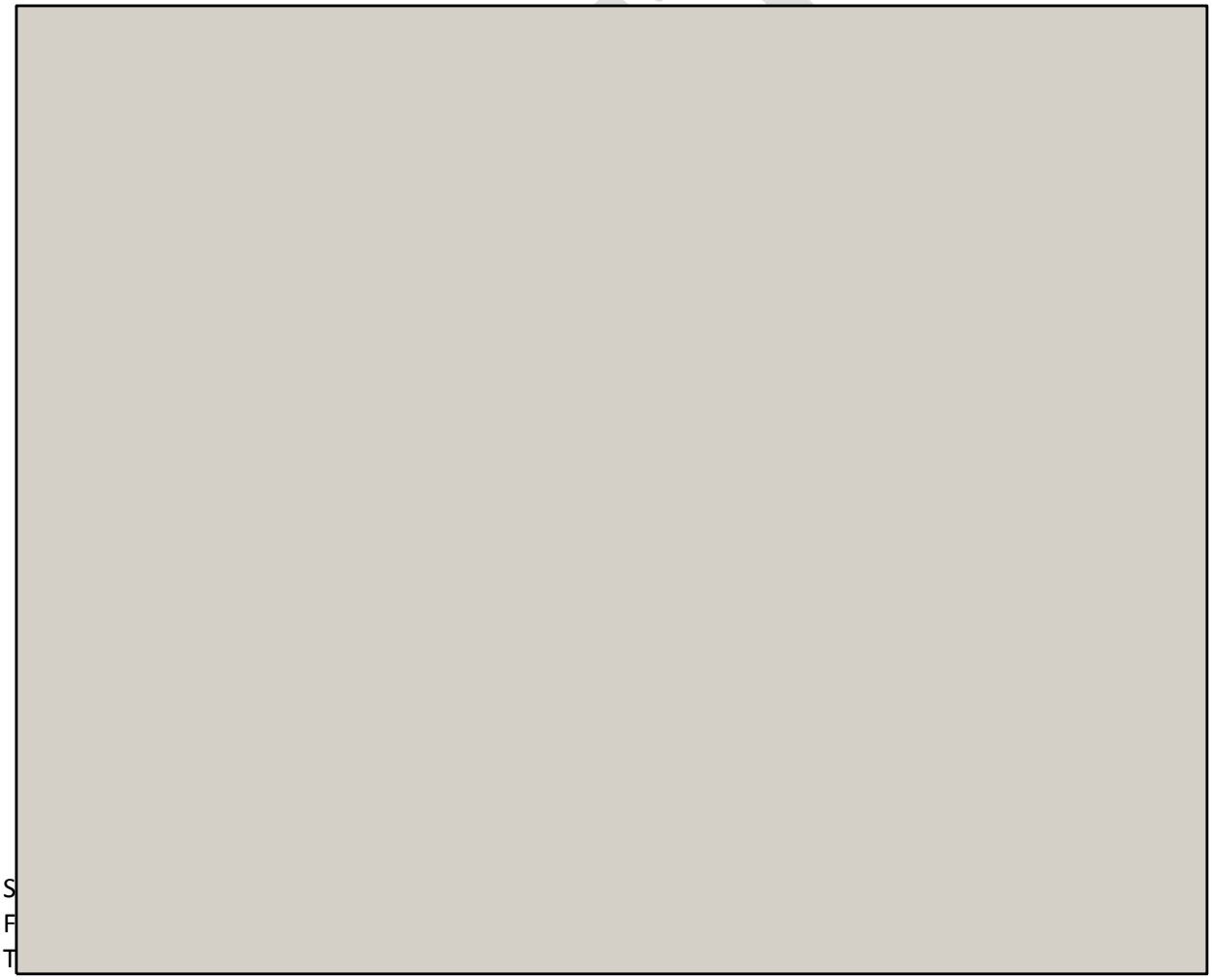
Figure 3: Wetlands Map of Seabrook, New Hampshire. Wetland delineated as poorly and very poorly drained soils, and Wetlands from the National Wetland Inventory.



The Town of Seabrook defines wetlands as "an area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions." Seabrook has two distinct wetland environments: tidal and fresh water. Tidal wetlands are dominant covering 1,734 acres, 31% of town, and comprise the largest expanse of this type of wetland in the state. Fresh water wetlands are also very prevalent in Seabrook covering 1,044 acres or 18% of town. Combined, tidal and fresh water wetlands cover 49% of the Town of Seabrook.

Floodplains for this *Plan* are defined as the 100-year and 500-year flood hazard zones, as depicted on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM). Floodplains in the Town of Seabrook are shown below in Figure 4. Seabrook maintains participation in the National Flood Insurance Program administered by FEMA. Development should be located away from wetlands and floodplains whenever possible. The filling of wetlands for building construction not only destroys wetlands and their numerous benefits but may also lead to groundwater contamination. Building within a flood zone may also reduce the floodplain's capacity to absorb and retain water during periods of excessive precipitation and runoff. Moreover, in regard to building within floodplains, contamination may result from flood damage to septic systems.

Figure 4: Floodplains of Seabrook, New Hampshire



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Development should be located away from wetlands and floodplains whenever possible. The filling of wetlands for building construction not only destroys wetlands and their numerous benefits but may also lead to groundwater contamination. Building within a flood zone may also

reduce the floodplain's capacity to absorb and retain water during periods of excessive precipitation and runoff.

Current and Future Development Trends

The Town of Seabrook has established several land use zones to guide growth and development. Zones include residential, industrial, commercial, mixed use, harbor, beach residential, beach commercial, and beach conservation. Current land use and development in the Town of Seabrook is dominated by commercial and residential uses. Residential development is scattered throughout Town on the available upland areas, with higher density development in the beach area. Commercial uses are most prevalent along Route 1, and Industrial development is common east of Interstate 95. The Town's Master Plan calls for wise use and protection of surface waters, wetlands, and aquifers.

According to building permit records from 2013 to 2017, the Town issued permits for 97 new residential units, 25 new commercial and 5 new industrial buildings. It is important that future development along the coast, harbor, and tidal rivers prepare for saltwater inundation from storm surge as well as sea level rise. Planning for these conditions will help future development in Seabrook be more resilient to the effects and impacts of a changing climate and a rising sea. To help investigate this, in 2009, Seabrook, with the assistance of the Rockingham Planning Commission, developed a plan, "Adaptation Strategies to Protect Areas of Increased Risk from Coastal Flooding Due to Climate Change." This plan contains information regarding research and findings about sea level rise, applicability to future land use, policy options to mitigate sea level rise flooding hazards and maps that depict storm surge inundation and an extended coastal flood hazard overlay. The Town should review the content of this plan, include pertinent information into future Master Plan exercises and chapters, and consider policy options to prevent development impacts from this likely flooding threat.

Map 1 – Existing Land Use

CHAPTER III. – NATURAL HAZARDS IN THE TOWN OF SEABROOK

What are the Hazards?

The first step in planning for natural hazard mitigation is to identify hazards that may affect the Town. Some communities are more susceptible to certain hazards (i.e., flooding near rivers, hurricanes on the seacoast, etc.). The Town of Seabrook is prone to several types of natural hazards. These hazards include: flooding, hurricanes or other high-wind events, severe winter weather, wildfires, earthquakes, drought, extreme temperatures, and sea level rise and coastal storm surge. Other natural hazards can and do affect the Town of Seabrook, but these were the hazards prioritized by the Committee for mitigation planning. These were the hazards that were considered to occur with regularity and/or were considered to have high damage potential and are discussed below.

Natural hazards that are included in the State's Hazard Mitigation Plan that are not included in the in this Plan Update include: landslide, subsidence, radon and avalanche. Subsidence and avalanche are rated by the State as having Low and No risk in Rockingham County, respectively; due to this they were left out of the Plan. Seabrook has no record of landslides and little chance of one occurring that could possibly damage property of cause injury; so, landslides were not included in this Plan. The State's Plan indicates that Rockingham County is at Moderate risk to radon; this hazard was not included in the Plan. When compared natural hazards that could be potentially devastating to the Town (earthquakes or hurricanes) or natural hazards that occur with regularity (flooding or severe winter weather) it was not considered an effective us of the Committee time to include radon in the *Plan* at this time. When the Plan is revised and updated in the future, possible inclusion of landslide, subsidence, radon and avalanche hazards will be reevaluated.

The hazard profiles below include a description of the natural hazard, the geographic location of each natural hazard (if applicable), the extent of the natural hazard (e.g. magnitude or severity), probability, past occurrences, and community vulnerability. Past occurrences of natural hazards were mapped on Map 2: Past and Future Hazards. Community vulnerability identifies the specific areas, general type of structures, specific structures, or general vulnerability of the Town of Seabrook to each natural hazard. Probability was defined as high, a roughly 66-100% chance of reoccurrence; medium, roughly a 33-66% chance of reoccurrence; and low, roughly a 0-33% of reoccurrence.

Flooding

Description - Floods are defined as a temporary overflow of water onto lands that are not normally covered by water. Flooding results from the overflow of major rivers and tributaries, storm surges, and/ or inadequate local drainage. Floods can cause loss of life, property damage, crop/livestock damage, and water supply contamination. Floods can also disrupt travel routes on roads and bridges.

Inland floods are most likely to occur in the spring due to the increase in rainfall and melting of snow; however, floods can occur at any time of the year. A sudden thaw in the winter or a major downpour in the summer can cause flooding because there is suddenly a lot of water in one place with nowhere to go.

100-year Floodplain Events - Floodplains are usually located in lowlands near rivers, and flood on a regular basis. The term 100-year flood does not mean that flood will occur once every 100 years. It is a statement of probability that scientists and engineers use to describe how one flood compares to others that are likely to occur. It is more accurate to use the phrase "1% annual chance flood". What this means is that there is a 1% chance of a flood of that size happening in any year. The flood hazard areas that are identified in Seabrook are defined as follows (according to FEMA's website: http://www.fema.gov/fhm/fq_term.shtm)

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zones AE and A1-A30 are the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, Base Flood Elevations (BFEs) derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. The depth should be averaged along the cross section and then along the direction of flow to determine the extent of the zone. Average flood depths derived from the detailed hydraulic analyses are shown within this zone. In addition, alluvial fan flood hazards are shown as Zone AO on the FIRM. Mandatory flood insurance purchase requirements apply.

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

Zone X is the flood insurance rate zones that correspond to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

Erosion and Mudslides - Erosion is the process of wind and water wearing away soil. Typically, in New Hampshire, the land along rivers is relatively heavily developed. Mudslides may be formed when a layer of soil atop a slope becomes saturated by significant precipitation and slides along a more cohesive layer of soil or rock. Erosion and mudslides become significant threats to development during floods. Floods speed up the process of erosion and increase the risk of mudslides.

Rapid Snow Pack Melt - Warm temperatures and heavy rains cause rapid snowmelt. Quickly melting snow coupled with moderate to heavy rains are prime conditions for flooding.

River Ice Jams - Rising waters in early spring often breaks ice into chunks, which float downstream and often pile up, causing flooding. Small rivers and streams pose special flooding risks because they are easily blocked by jams. Ice in riverbeds and against structures presents significant flooding threats to bridges, roads, and the surrounding lands.

Severe Storms - Flooding associated with severe storms can inflict heavy damage to property. Heavy rains during severe storms are a common cause of inland flooding.

Sea Level Rise, Coastal Flooding and Storm Surge - Seabrook's tidal coastline along the Atlantic Ocean and Hampton-Seabrook Harbor means homes and businesses, roadways and infrastructure, and critical natural habitats such as salt marsh and mud flats are at risk due to coastal flooding caused by storm surges and rising sea levels.

Research shows the climate of New Hampshire and the Seacoast region has changed over the past century and predicts the future climate of the region will be affected by human activities that are warming the planet. Overall, New England has been getting warmer and wetter over the last century, and the rate of change has increased over the last four decades. The challenges posed by climate change, such as more intense storms, frequent heavy precipitation, heat waves, drought, extreme flooding, and higher sea levels could significantly alter the types and magnitudes of hazards faced by Seabrook.

The Town's 2017 Vulnerability Assessment identified potential impacts from a changing climate, and produced a set of flood elevation maps, sea-level rise scenarios, and recommendations for adaptation planning.

Location - Seabrook is vulnerable to flooding in several locations. Generally, the Town is at risk within the Flood Zones identified by FEMA on Flood Insurance Rate Maps (FIRM). There are also several areas susceptible to flooding that are not within these flood zones, these areas are listed below and displayed on Map 2: Past and Future Hazards.

- US Route 1 at Cains Brook, adjacent to Home Depot
- Stone arch under railroad bridge behind Home Depot on Cains Brooks
- South Main St., west of the transfer station
- Route 286 at the west side of the Blackwater River
- Intersection of Route 1A and Route 286
- River Street
- Cross Beach Road
- Causeway Street
- Woodstock Street
- Hamel Dam, Walton Road

Extent - The extent of the flood zones can be seen in Map 2: Past and Future Hazards. This area includes FIRM Zones A and X, as well as, areas of locally chronic flood problems.

Probability - High.

Past Occurrence - Flooding is a common hazard for the Town of Seabrook. Several locations were identified by the Committee as areas of chronic reoccurring flooding or high potential for future flooding, as listed above and identified on Map 2.

Community Vulnerability:

- Infrastructure listed above
- Stone arch on Cain's Brook
- Structures located in the flood zone
- Culverts
- Basements
- Erodible soils

National Flood Insurance Program (NFIP) - In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer funded disaster relief for flood victim and the increasing amount of damage caused by floods. The Federal Insurance and Mitigation Administration (FIMA) a component of the Federal Emergency Management Agency (FEMA) manages the NFIP and oversees the floodplain management and mapping components of the program.

Communities participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce flood damage. In exchange, the NFIP makes federally subsidized flood insurance available to homeowners, renters, and business owners in these communities. Flood insurance, Federal Grants and loans, Federal disaster assistance and federal mortgage insurance is unavailable for the acquisition or construction of structures located in the floodplain shown on the NFIP maps for those communities that do not participate in the program.

To get secure financing to buy, build or improve structures in the Special Flood Hazard areas, it is legally required by federal law to purchase flood insurance. Lending institutions that are federally regulated or federally insured must determine if the structure is in the SFHA and must provide written notice requiring flood insurance. Flood insurance is available to any property owner located in a community participating in NFIP.

Repetitive Loss Properties - A specific target group of repetitive loss properties is identified and serviced separately from other NFIP policies by the Special Direct Facility (SDF). The target group includes every NFIP insured property that, since 1978 and regardless of any change(s) of ownership during that period, has experienced four or more paid losses, two paid flood losses within a 10-year period that equal or exceed the current value of the insured property, or three or more paid losses that equal or exceed the current value of the insured property, regardless of any changes of ownership, since the buildings construction or back to 1978. Target group policies are afforded coverage, whether new or renewal, only through the SDF.

The FEMA Regional Office provides information about repetitive loss properties to State and local floodplain management officials. The FEMA Regional Office may also offer property owners building inspection and financial incentives for undertaking measures to mitigate future flood losses. These measures include elevating buildings from the flood area, and in some cases drainage improvement projects. If the property owners agree to mitigation measures, their property may be removed from the target list and would no longer be serviced by the SDF.

Table 1: Seabrook NFIP Policy and Loss Statistics

Policies in force	Insurance in Force	Number of Paid Losses (since 1978)	Total Losses Paid (Since 1978)
85	$15,895,300	36	$168,092
Source: FEMA Policy and claims database, as of March, 2018			

Seabrook NFIP Repetitive Flooding Losses - The Town of Seabrook and the Village Beach District have been a part of NFIP since 1986. As of March 2018, Seabrook has had 6 repetitive loss properties according to New Hampshire Office of Strategic Initiatives records. This is determined by any repetitive damage claims on those properties that hold flood insurance through the NFIP.

Floodplain Management Goals/Reducing Flood Risks - A major objective to floodplain management is to continue participation in the NFIP. Communities that agree to manage Special Flood hazard Areas shown on NFIP maps participate in the NFIP by adopting minimum standards. The minimum requirements are the adoption of the floodplain Ordinances and Subdivision/Site Plan Review requirements for land designated as Special Flood hazard Areas. Under Federal Law, any structure located in the floodplain is required to have flood insurance. Federally subsidized flood insurance is available to any property owner located in a community participating in the NFIP. Communities that fail to comply with the NFIP will be put on probation and/or suspended. Probation is a first warning where all policy holders receive a letter notifying them of a $50 increase in their insurance. In the event of suspension, the policyholders lose their NFIP insurance and are left to purchase insurance in the private sector, which is of significantly higher cost. If a community is having difficulty complying with NFIP policies, FEMA is available to meet with staff and volunteers to work through the difficulties and clear up any confusion before placing the community on probation or suspension.

Potential Administrative Techniques to Minimize Flood Losses in Seabrook - A potential step in mitigating flood damage is participating in NFIP. Seabrook continues to consistently enforce NFIP compliant policies to continue its participation in this program and has effectively worked within the provisions of NFIP. Below is a list of actions Seabrook should consider, or continue to perform, to comply with NFIP:

- Participate in NFIP training offered by the State and/or FEMA (or in other training) that addresses flood hazard planning and management;
- Establish Mutual Aid Agreements with neighboring communities to address administering the NFIP following a major storm event;

- Address NFIP monitoring and compliance activities;
- Revise/adopt subdivision regulations, erosion control regulations, board of health regulations to improve floodplain management in the community;
- Prepare, distribute or make available NFIP insurance and building codes explanatory pamphlets or booklets;
- Identify and become knowledgeable of non-compliant structures in the community;
- Inspect foundations at time of completion before framing to determine if lowest floor is at or above Base Flood Elevation (BFE), if they are in the floodplain;
- Require the use of elevation certificates;
- Enhance local officials, builders, developers, local citizens and other stakeholders' knowledge of how to read and interpret the FIRM;
- Work with elected officials, the state and FEMA to correct existing compliance issues and prevent any future NFIP compliance issues through continuous communications, training and education.

Hurricane-High Wind Events

Description - Significantly high winds occur especially during hurricanes, tornadoes, winter storms and thunderstorms. Falling objects and downed power lines are dangerous risks associated with high winds. In addition, property damage and downed trees are common during high wind occurrences.

Hurricanes - A hurricane is a tropical cyclone in which winds reach speeds of 74 miles per hour or more and blow in a large spiral around a relatively calm center. The eye of the storm is usually 20-30 miles wide and may extend over 400 miles. High winds are a primary cause of hurricane-inflicted loss of life and property damage. Hurricanes can also include coastal storm surge. The Saffir–Simpson hurricane wind scale (SSHWS), or the Saffir–Simpson hurricane scale (SSHS) for short, classifies hurricanes into five categories distinguished by the intensities of their sustained winds. To be classified as a hurricane, a tropical cyclone must have maximum sustained winds of at least 74 mph, Category 1. The highest classification in the scale, Category 5, is reserved for storms with winds exceeding 156 mph. The Saffir/Simpson Hurricane Scale is included in Appendix C.

Tornadoes - A tornado is a violent windstorm characterized by a twisting, funnel shaped cloud. They develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. The atmospheric conditions required for the formation of a tornado include great thermal instability, high humidity and the convergence of warm, moist air at low levels with cooler, drier air aloft. Most tornadoes remain suspended in the atmosphere, but if they touch down they become a force of destruction.

Tornadoes produce the most violent winds on earth, at speeds of 280 mph or more. In addition, tornadoes can travel at a forward speed of up to 70 mph. Damage paths can be in excess of one mile wide and 50 miles long. Violent winds and debris slamming into buildings cause the most structural damage. The Enhanced Fujita Scale is the standard scale for rating the severity of a

tornado as measured by the damage it causes. A tornado is usually accompanied by thunder, lightning, heavy rain, and a loud "freight train" noise. In comparison with a hurricane, a tornado covers a much smaller area but can be more violent and destructive.

Severe Thunderstorms - All thunderstorms contain lightning. During a lightning discharge, the sudden heating of the air causes it to expand rapidly. After the discharge, the air contracts quickly as it cools back to ambient temperatures. This rapid expansion and contraction of the air causes a shock wave that we hear as thunder, which can damage building walls and break glass.

Lightning - Lightning is a giant spark of electricity that occurs within the atmosphere or between the atmosphere and the ground. As lightning passes through air, it heats the air to a temperature of about 50,000 degrees Fahrenheit, considerably hotter than the surface of the sun. Lightning strikes can cause death, injury and property damage.

Hail - Hailstones are balls of ice that grow as they're held up by winds, known as updrafts, which blow upwards in thunderstorms. The updrafts carry droplets of supercooled water – water at a below freezing temperature – but not yet ice. The supercooled water droplets hit the balls of ice and freeze instantly, making the hailstones grow. The faster the updraft, the bigger the stones can grow. Most hailstones are smaller in diameter than a dime, but stones weighing more than a pound have been recorded. Details of how hailstones grow are complicated, but the results are irregular balls of ice that can be as large as baseballs, sometimes even bigger. While crops are the major victims, hail is also a hazard to vehicles and windows.

Location - Hurricane events are more potentially damaging with increasing proximity to the coast. Seabrook's proximity to the Atlantic Coast makes hurricanes and high wind events severe threats. For this Plan, high-wind events were considered to have an equal chance of affecting any part of the Town of Seabrook

Extent – Hurricane strength is measured using the Saffir-Simpson scale, located in the appendix of this Plan. Seabrook is located within Zone II hurricane-susceptible region (indicating a design wind speed of 160 mph). From 1950 to 2018 Rockingham County was subject to 9 tornado events, these included 2 type F0 (Gale Tornado, 40-72 mph), 2 type F1 (Moderate Tornado, 73-112 mph), 4 type F2 (Significant Tornado, 113-157 mph) and 1 type F3 (Severe Tornado, 158-206 mph). Type 3 tornados can cause severe damage including tearing the roofs and walls from well-constructed homes, trees can be uprooted, trains over-turned, and cars lifted off the ground and thrown. Between 1900 and 2018 2 hurricanes have made landfall in New Hampshire, a category 1 and a category 2.

Probability -High. The State of New Hampshire's Multi-Hazard Mitigation Plan Update 2013 rates Rockingham County with high likelihood of hurricane, tornado and "Nor'-Easters" events. Also, it rates the risk of downbursts, lightning and hail events as moderate.

Past Occurrence – Between 1635 and 2018 14 hurricanes have impacted the State of New Hampshire. The worst of these occurred on September 21, 1938, with wind speeds of up to 186 mph in MA and 138 mph elsewhere. Thirteen of 494 people killed by this storm were residents of New Hampshire. The Storm caused $12,337,643 in damages (1938 dollars), timber not

included. Hurricanes Sandy and Irene created areas of localized flooding in Seabrook and power loss. High wind events in 2010, 2014 and 2016 resulted in extensive power outages, downed wires and trees. Tornadoes have not impacted Seabrook in recent memory.

Community Vulnerability – The Committee determined that high wind, storm surge and heavy rain associated with hurricanes can impact every neighborhood in Seabrook before, during and after the storm, resulting in downed trees, flooding of ponds, rivers, streams, roads and basements, and damage to home, businesses and infrastructure. Infrastructure at Seabrook Harbor, including the piers, bulkhead and retaining wall are critical economic infrastructure at risk of damage from hurricanes.

Severe Winter Weather

Description – Severe winter weather in the form of heavy snow storms, ice storms and Nor'easters are a threat to the community with subzero temperatures from extreme wind chill and storms causing low visibility for commuters. Heavy snow loads from storms are known to collapse buildings. Ice storms disrupt power and communication services. Extreme cold affects vulnerable populations, including the elderly.

Heavy Snow Storms - A winter storm can range from moderate snow to blizzard conditions. Blizzard conditions are considered blinding wind-driven snow over 35 mph that lasts several days. A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period.

Ice Storms - An ice storm involves rain, which freezes upon impact. Ice coating at least one-fourth inch in thickness is heavy enough to damage trees, overhead wires and similar objects. Ice storms also often produce widespread power outages.

Nor'easter - A Nor'easter is large weather system traveling from South to North passing along or near the seacoast. As the storm approaches New England and its intensity becomes increasingly apparent, the resulting counterclockwise cyclonic winds impact the coast and inland areas form a Northeasterly direction. The sustained winds may meet or exceed hurricane force, with larger bursts, and may exceed hurricane events by many hours (or days) in terms of duration.

Location - Severe winter weather events have an equal chance of affecting any part of the Town of Seabrook.

Extent - Large snow events in Southeastern New Hampshire can produce 30 inches of snow. Portions of central New Hampshire recorded snowfalls of 98" during one slow moving storm in February of 1969. Ice storms occur with regularity in New England. The Sperry-Piltz ice accumulation scale is found in the Appendix of this Plan. Seven severe ice storms have been recorded that affected New Hampshire since 1929. These events caused disruption of transportation, loss of power and millions of dollars in damage.

Probability - High. The State of New Hampshire's Multi-Hazard Mitigation Plan Update 2013 rates Rockingham County with high likelihood of heavy snows and ice storms.

Past Occurrence – Seabrook has been impacted by several severe winter storms in the past five years. A storm on January 2, 2009 resulted in the removal of tree debris and wind-blown debris. A storm on March 29, 2010 caused flooding that damaged roads and culverts. The "Halloween storm" on October 31, 2011 resulted in widespread power outages, fallen trees, and closed roads. A severe winter storm struck the region on March 19, 2013 with heavy snow fall resulting in 48 hours of snow removal. A severe winter storm in 2015 and two Nor'easters in 2018 required extensive snow removal, removal of fallen trees, and repairs to roadways and infrastructure along the beach and harbor.

Community Vulnerability - Severe winter weather has struck Seabrook and every other community in the region on an annual basis in recent memory. The Committee determined that heavy snow, strong and gusty winds, and frigid temperatures can impact all parts of town equally, resulting in downed trees and power lines, extended power outages, and unsafe driving condition. Extended power outages and the resulting loss of heat in homes of elderly residents are of concern. Rapid snow melt after severe winter weather can result in flooding of rivers and streams, posing risk to roads and structures. The Committee identified the elderly and vulnerable populations, utility lines and towers, and trees at greatest risk from severe winter weather.

Wildfire

Description - Wildfire is defined as an uncontrolled and rapidly spreading fire, including grass and forest fires. A forest fire is an uncontrolled fire in a woody area. They often occur during drought and when woody debris on the forest floor is readily available to fuel the fire. Grass fires are uncontrolled fires in grassy areas.

Seabrook is at risk to wildfires associated with Phragmites Australis: A very tall grass that proliferates in brackish water near the coast. This plant is a recognized fire danger. The National Fire Danger Rating System has designated this type of marsh grass as a fire hazard. Phragmites is a prolific species that spreads by its root system and can grow to be over 12 feet in height. Grass fires in beach dunes also pose a risk, as do fires ignited by the illegal use of fireworks in the beach district.

Location – Areas identified areas at-risk of wildfire are located on Map 2 Past and Future Hazards and include Farm Lane and Lake Shore Drive.

Extent - A wildfire in the Town of Seabrook is unlikely, but if a crown fire were to occur it could be very damaging to several small sections of Town. Wildfires associated with the Phragmites would affect areas adjacent to salt marsh, tidal creeks and the coastal beaches. The Wildland-Urban Interface Scale, a tool to quantify the expected severity of wildfire events in developed areas, is included in Appendix K.

Probability - Moderate. The State of New Hampshire's Multi-Hazard Mitigation Plan Update 2013 rates Rockingham County with moderate risk to wildfires.

Twenty years ago, Phragmites was in a few isolated pockets; today it covers hundreds of acres in New Hampshire's salt marshes. Although, this type of fire has not occurred often in the past, it is becoming more prevalent as Phragmites spreads.

Past Occurrence – In 1996 a controlled burn fire was started in Seabrook. However, due to the density of the Phragmites, the fire burned so hot, it melted the vinyl siding off a nearby house. That fire was the impetus for a current Phragmites elimination project at that site funded by the NH Coastal Program. A fire in nearby Salisbury, MA on April 8, 1999 is indicative of the danger that Phragmites poses. This fire began in the Phragmites and within 20 minutes had consumed 7 acres of the marsh. The fire then jumped a road, burned down a vacant home and threatened three other occupied dwellings. Fire fighters responding from 4 communities saved these dwellings. Seabrook was one of the fire departments to respond and the firefighters spent 6 hours bringing the blaze completely under control. Although the three houses were saved, one of them lost the vinyl siding on one side of the house and at least one outbuilding was lost.

Community Vulnerability - The Committee determined that all forested and open areas in Seabrook are prone to wildfires as well as coastal areas with Phragmites. The threat increases during periods of drought. The Committee summarized the threat as follows:

- Structures located near large open vegetated areas prone to lightning strikes
- Vulnerability increases during drought events
- Tree debris created by high wind and winter storm events

Earthquakes

Description – Seismic activity including landslides and other geologic events. Geologic events are often associated with California, but New England is considered a moderate risk earthquake zone. An earthquake is a rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and often cause landslides, flash floods, fires, and avalanches. Larger earthquakes usually begin with slight tremors but rapidly take the form of one or more violent shocks, and end in vibrations of gradually diminishing force called aftershocks. The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. The magnitude and intensity of an earthquake is determined using scales such as the Richter Magnitude Scale, located in the Appendix of this Plan.

Location – An earthquake has an equal chance of affecting all areas on Seabrook.

Extent - New England is particularly vulnerable to the injury of its inhabitants and structural damage because of our built environment. Few New England States currently include seismic design in their building codes. Massachusetts introduced earthquake design requirements into their building code in 1975 and Connecticut very recently did so. However, these specifications are for new buildings, or very significantly modified existing buildings only. Existing buildings, bridges, water supply lines, electrical power lines and facilities, etc. have rarely been designed for earthquake forces (New Hampshire has no such code specifications).

Probability - Moderate. The State of New Hampshire's Multi-Hazard Mitigation Plan 2013 ranks all the Counties in the State with at moderate risk to earthquakes.

Past Occurrence - Large earthquakes have not affected the Town of Seabrook within recent memory.

Community Vulnerability - The Committee determined that earthquakes do not pose a frequent threat to Seabrook, but if one were to occur the most vulnerable structures include dams, bridges, brick structures, infrastructure and utility lines, as well as secondary hazards such as fire, power outages or a hazardous material leak or spill.

Sea Level Rise, Coastal Storms and Storm Surge

Description - The State's Atlantic seacoast and estuaries are vulnerable to extremes of storm water runoff and storm surge from coastal storms and hurricanes. A storm surge, especially when coupled with astronomical high tides and sea level rise, presents a threat to all land areas adjacent to the marine environment.

Location - The Town's Vulnerability Assessment Report of Sea Level Rise and Coastal Storm Surge Flooding, completed by the Rockingham Planning Commission in 2015, identifies areas in town at risk of flooding from expected increases in storm surge and rates of sea level rise

Extent - Coastal storms could affect much of Seabrook, due to the Town's low elevation. Assuming that the Town is vulnerable to category 3 hurricanes, the potential storm surge related to such a wind event could reach several feet above normal sea level.

Probability - High. The State of New Hampshire's Natural Hazards Mitigation Plan rates Rockingham County with high likelihood of storm surge and hurricane events.

Past Occurrence – A list of coastal storms that have resulted in storm surge are listed in Table 2.

Community Vulnerability – The 2015 Vulnerability Assessment indentified and mapped the following assets and resources as being vulnerable to sea level rise and coastal storm surge:

- Evacuation routes
- Municipal facilities, including Seabrook Elementary – Middle School
- Waste Water treatment plant
- Erosion of the harbor bulkhead and retaining wall
- Sewage pump stations at River Street, north of the Welcome Center on Route 1A, bridge at Causeway Street, Cross Beach Road
- Sewer main under Route 286
- Sewer line across the harbor to Hampton servicing Sun Valley at Seabrook Beach
- Water pump station at Cross Beach Road
- NHDOT transportation infrastructure
- State and Municipal culverts
- Bridges

- Harbor and marinas
- Seabrook Station access road and parking lot
- Tidal and freshwater wetlands
- Aquifers
- NH Fish and Game Wildlife Action Plan Tier 1 and Tier 2 habitats

Drought

Description - Drought is a period of unusually constant dry weather that persists long enough to cause deficiencies in water supply (surface or underground). Droughts are slow-onset hazards that can severely affect municipal water supplies, crops, recreation resources, and wildlife. If drought conditions extend over several years, the direct and indirect economic impacts can be significant. High temperatures, high winds, and low humidity can worsen drought conditions and make area more susceptible to wildfire. In addition, human actions and demands for water resources can accelerate drought-related impacts.

Location – The Committee determined that drought poses risks to water supplies throughout Town, both private and municipal. Risks of wildfire associate with drought conditions are greatest in forested and open grassland areas and coastal areas with Phragmites.

Extent - Although New Hampshire is typically thought of as a water-rich state, there are times the demand for water can be difficult to meet. A combination of increased population and extended periods of low precipitation can cause reduced water supplies. Drought can impact Seabrook after extended periods with limited rain and snowfall, often for several months.

Probability - Low.

Past Occurrence - The State of New Hampshire Multi-Hazard Mitigation Plan Update 2013 rates Rockingham County at low risk for drought. However, drought conditions persisted across southern New Hampshire for much of 2016, resulting in the Town of Seabrook issuing a restriction on outdoor watering

Community Vulnerability - The Committee determined that water supply and fire flow are the most at risk due to drought conditions. The Town has developed a groundwater management plan to guide the efficient use of water resources.

Extreme Temperatures

Description - Extreme temperatures are typically recognized as conditions where temperatures consistently stay ten degrees or more above a region's average high temperature for a 24-72 hour (extreme heat) or stay ten degrees or more below a region's average low temperature for a 24-72-hour period (extreme cold). Fatalities can result from extreme temperatures, as they can push the human body beyond its limits.

Location – Extreme temperatures can affect all areas of Seabrook.

Extent - Extreme heat events impact Seabrook for 2-3 days each summer, and extreme cold events impact the Town 5-7 days each winter. FEMA's Heat Index measures a number in degrees Farenheit that tells how hot it feels when relative humidity is added to the air temperature.

Probablility – High.

Past Occurrence - Annually

Community Vulnerability - The Committee determined that all parts of Seabrook are at risk of impacts associated with extreme temperatures. High temperatures during the busy summer tourist season results in higher water consumption by people and Seabrook Station. The young, elderly and vulnerable populations are especially vulnerable to heat stroke. The EMD maintains a list of these populations, including addresses for homes, day care centers, and congregate care facilities.

Table 2: State of New Hampshire
Presidentially Declared Disasters (DR) and Emergency Declarations (EM) 1982-2018
Source: *State of NH Multi-Hazard Mitigation Plan, 2013 Update and FEMA*

Date Declared	Event	FEMA DR	Program	Amount	Counties Declared
08/27/86	Severe storms/flooding	FEMA-771-DR	PA	$1,005,000	Cheshire and Hillsborough
04/16/87	Severe storms/flooding	FEMA-789-DR	PA/IA	$4,888,889	Carroll, Cheshire, Grafton, Hillsborough, Merrimack, Rockingham, and Sullivan
08/29/90	Severe storms/winds	FEMA-876-DR	PA	$2,297,777	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, and Sullivan
09/09/91	Hurricane	FEMA-917-DR	PA	$2,293,449	Statewide
11/13/91	Coastal storm/flooding	FEMA-923-DR	PA/IA	$1,500,000	Rockingham
03/16/93	Heavy snow	FEMA-3101-DR	PA	$832,396	Statewide
01/03/96	Storms/floods	FEMA-1077-DR	PA	$2,220,384	Carroll, Cheshire, Coos, Grafton, Merrimack, and Sullivan
10/29/96	Severe storms/flooding	FEMA-1144-DR	PA	$2,341,273	Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
01/15/98	Ice storm	FEMA-1199-DR	PA/IA	$12,446,202	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Strafford, and Sullivan
07/02/98	Severe storms	FEMA-1231-DR	PA/IA	$3,420,120	Belknap, Carroll, Grafton, Merrimack, Rockingham, and Sullivan
10/18/99	Hurricane/tropical storm Floyd	FEMA-1305-DR	PA	$750,133	Belknap, Cheshire, and Grafton
3/2001	Snow emergency	FEMA-3166-EM	PA	$4,500,000	Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, and Strafford
2/17/2003 - 2/18/2003	Snow emergency	FEMA-3177-EM	PA	$3,000,000	Cheshire, Hillsborough, Merrimack, Rockingham, and Strafford
09/12/03	Severe storms/flooding	FEMA-1489-DR	PA	$1,300,000	Cheshire and Sullivan
03/11/03	Snow emergency	FEMA-3177-EM	PA	$3,000,000	Cheshire, Hillsborough, Merrimack, Rockingham, and Strafford

01/15/04	Snow emergency	FEMA-3193-EM	PA	$3,200,000	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, and Sullivan
03/30/05	Snow emergency	FEMA-3207-EM	PA	$4,654,738	Belknap, Carroll, Cheshire, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
03/30/05	Snow emergency	FEMA-3208-EM	PA	$1,417,129	Carroll, Cheshire, Coos, Grafton, and Sullivan
04/28/05	Snow emergency	FEMA-3211-EM	PA	$2,677,536	Carroll, Cheshire, Hillsborough, Rockingham, and Sullivan
10/26/05	Severe storm/flooding	FEMA-1610-DR	PA/IA	$14,996,626	Belknap, Cheshire, Grafton, Hillsborough, Merrimack, and Sullivan
05/31/06	Severe storm/flooding	FEMA-1643-DR	PA/IA	$17,691,586	Belknap, Carroll, Grafton, Hillsborough, Merrimack, Rockingham, and Strafford
4/15/2007 - 4/23/2007	Severe storm/flooding	FEMA-1695-DR	PA/IA	$27,000,000	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
08/11/08	Severe storms/tornado/flooding	FEMA-1782-DR	PA	$1,691,240	Belknap, Carroll, Merrimack, Rockingham, and Strafford
09/05/08	Severe storms/flooding	FEMA-1787-DR	PA	$4,967,595	Belknap, Coos, and Grafton
10/03/08	Severe storms/flooding	FEMA-1799-DR	PA	$1,050,147	Hillsborough and Merrimack
12/11/08	Severe winter storm	FEMA-3297-EM	DF A/P A	$900,000	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
01/02/09	Severe winter storm	FEMA-1812-DR	DF A/P A	$19,789,657	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
03/29/10	Severe winter storm	FEMA-1892-DR	PA	$9,103,138	Merrimack, Rockingham, Strafford, and Sullivan
05/12/10	Severe winter storm	FEMA-1913-DR	PA	$3,057,473	Hillsborough and Rockingham
07/22/11	Severe storms/flooding	FEMA-4006-DR	PA	$1,664,140	Coos and Grafton

09/03/11	Tropical storm Irene	FEMA-4026-DR	PA/IA	$11,101,752	Belknap, Carroll, Coos, Grafton, Merrimack, Strafford, and Sullivan
12/07/11	October Nor'easter	FEMA-4049-DR	PA	$4,411,457	Hillsborough and Rockingham
06/18/12	Severe storms/flooding	FEMA-4065-DR	PA	$3,046,189	Cheshire
10/30/12	Hurricane Sandy	DR-4095 EM-3360	PA DFA	$2,132,376	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
2/8/2013 - 2/10/2013	Severe storm/blizzard	DR-4105	PA	$6,127,598	Belknap, Carroll, Cheshire, Hillsborough, Merrimack, Strafford, and Rockingham
6/26/2013 – 7/3/2013	Severe storms/flooding	DR-4139	PA	$6,389,705	Cheshire, Sullivan, and Grafton
1/26/2015 – 1/29/2015	Severe winter storm/snowstorm	DR-4209	PA	$4,607,527	Strafford, Rockingham, and Hillsborough
3/14/2017 – 3/15/2017	Severe winter storm/snowstorm	DR-4316	PA	$80,306.55	Belknap and Carroll
1/1/2017 – 1/2/2017	Severe storms/flooding	DR-4329	PA	NA	Grafton and Coos
10/29/2017 11/1/2017	Severe Storm/flooding	DR-4355	PA	NA	Sullivan, Merrimack, Belknap, Carroll, Grafton, Coos
Program Key: PA: Public Assistance IA: Individual Assistance DFA: Direct Federal Assistance					

Map 2: Insert Past and Future Hazards

CHAPTER IV – CRITICAL FACILITIES

The Critical Facilities List for the Town of Seabrook has been identified by Seabrook's Hazard Mitigation Committee and is broken up into four categories. The first category contains facilities needed for Emergency Response in the event of a disaster. The second category contains Non-Emergency Response Facilities that have been identified by the committee as non-essential but important to the daily operation of the town. The third category contains Facilities/Populations that the committee wishes to protect in the event of a disaster. The fourth category contains Potential Resources, which can provide services or supplies in the event of a disaster. Map 3: Critical Facilities at the end of this Chapter identifies the location of the facilities and the evacuation routes. A detailed description of critical facilities can be found in Table 3 through Table 6.

Table 3: Category 1 - Emergency Response Services and Facilities

Critical Facility	Facility Type	Address	Comments
Seabrook Town Office	Town Hall	99 Lafayette Rd	Back Up Power
Seabrook Station	Nuclear Power Plant	626 Lafayette Rd	Nuclear Power Plant
Seabrook Police Station	Police Station	7 Liberty Ln.	Back-up Power
Seabrook Fire Department	Fire Station	87 Centennial Rd.	Emergency Operations Center/Back up Power
Seabrook Public Works	Public Works Garage	43 Railroad Ave.	Back-up Power
Seabrook Community Center	Municipal building	311 Lafayette Rd.	Warming and cooling shelter
Route 107 Bridge	Bridge	NH 107	Evacuation Route
Route 1A Draw Bridge	Bridge - Hampton	NH 1A	Evacuation Route
Rt. 286 Bridge over Black Water River	Bridge	NH 286	Evacuation Route
Causeway Street over Mill Creek Bridge	Bridge	Causeway St.	Evacuation Route
Centennial Road over Mill Creek Bridge	Bridge	Centennial Rd.	Evacuation Route

Table 4: Category 2 - Non-Emergency Response Facilities

The town has identified these facilities as non-emergency facilities; however, they are considered essential for the everyday operation of Seabrook.

Critical Facility	Facility Type	Address	Comments
Seabrook Waste Water Plant	Sewage Facility	274 Rte 286, Wrights Island	Back Up Power
Sewage Pump Stations 1 - 19	Sewage Facilities	Sewer Department	
Water Treatment Plant	Water Facility	550 Rte 107	Back Up Power
Seabrook Transfer Station	Transfer Station	70 Rocks Rd.	
Storm Water Pump Station	Water Facility		
Storm Water Pump Station	Water Facility		
Water Tanks 1 and 2	Water Facility		
Water Wells 1-12	Water Facilities		Back Up Power
Hamel Dam	Dam	Walton Road	Hazard Class A (Low Hazard)
Cains Brook Dam at Lakeshore Drive	Dam		Hazard Class A (Low Hazard)
Cains Mill Pond Dam	Dam		Hazard Class A (Low Hazard)
Secord Pond Dam	Dam		Hazard Class A (Low Hazard)

Table 5: Category 3 - Facilities/Populations to Protect

The third category contains people and facilities that need to be protected in event of a disaster.

Critical Facility	Facility Type	Address	Comments
Cemetery	Cemetery	28 Lafayette Rd, 879 Lafayette Rd., 132 South Main St.	
Aero Dynamic Industries	Hazardous Material Storage	142 Batchelder Rd.	Storage
Atomic Fireworks	Special Hazardous Material Storage	287 Lafayette Rd.	
Bocra Industries	Hazardous Material Storage	140 Batchelder Rd.	
Bond Adhesives	Hazardous Material Storage	896 Lafayette Rd.	
Coastal Hydraulics	Hazardous Material Storage	28 Rte 286	
Corium Corporation	Hazardous Material Storage	9 Batchelder Rd.	

Critical Facility	Facility Type	Address	Comments
ERA Industries	Hazardous Material Storage	142 Batchelder Rd.	
Fantasy Fireworks	Special Hazardous Material Storage	571 Lafayette Rd.	
Fireworks Over the Border	Special Hazardous Material Storage	443 State Rd Rte 286	
Hannah International Foods, Inc.	Hazardous Material Storage	1 Hannah Dr.	
J&C Industries	Hazardous Material Storage	21 Batchelder Rd.	
LocTite	Hazardous Material Storage	167 Batchelder Rd.	
MacKenzie Heating & Cooling	Hazardous Material Storage	28 London Ln.	
Microvision Inc.	Hazardous Material Storage	20 London Ln.	
RG Machine Inc.	Hazardous Material Storage	9 Whitakers Way	
Rockingham Fireworks	Special Hazardous Material Storage	780 Lafayette Rd.	
Rudy Fireworks Enterprises Inc	Special Hazardous Material Storage	919 Lafayette Rd. Unit 7	
Seabrook International	Hazardous Material Storage	15 & 35 Woodworkers Way	
Smokey Quartz Distillery	Hazardous Material Storage	894 Lafayette Rd.	
Syvinski Landscaping Inc	Hazardous Material Storage	151 Batchelder Rd.	
US Foods	Hazardous Material Storage	100 Ledge Rd	
Waterline Industries	Hazardous Material Storage	7 London Ln.	
Industrial Facility	Industry	725 Ocean Blvd.	
Seabrook Library	Library	25 Liberty Ln.	
Four Corners Church	Religious Facility	1 Farm Ln.	
Healing Rain Ministries	Religious Facility	49 New Zealand Rd.	
Rand Memorial Church	Religious Facility	134 South Main St.	
Seabrook Church of Christ	Religious Facility	867 Lafayette Rd.	
St Elizabeth's	Religious Facility	1 Lowell St.	

Critical Facility	Facility Type	Address	Comments
Trinity United	Religious Facility	103 Lafayette Rd.	
Seabrook Community Center	Community Center	311 Lafayette Rd.	Backup Power/Also listed in Category 4
Seabrook Elementary and Middle School	School	256 Walton Rd.	Also listed in Category 4
Head Start	Child care	146 Lafayette Rd.	
Rockingham CAP	Child care	146 Lafayette Rd.	
Miss Beth's Daycare	Child care	3 Dandiview Acres	d.b.a. Over the Rainbow Day School
Seabrook Emergency Room	Medical Facility	603 Lafayette Rd.	

Table 6: Category 4 - Potential Resources

This category contains facilities that provide potential resources for services or supplies in the event of a natural disaster.

Critical Facility	Facility Type	Address	Comments
Cargo Landing Pad	Aviation	725 Ocean Blvd.	
Seabrook Community Center	Shelter	311 Lafayette Rd.	Also listed in Category 3

Map 3: Critical Facilities Map

CHAPTER V. – POTENTIAL HAZARD DAMAGE

Identifying Vulnerable Facilities

It is important to determine which critical facilities are the most vulnerable and to estimate their potential loss. The first step is to identify the facilities most likely to be damaged in a hazard event. To do this, the location of critical facilities illustrated on Map 3 was compared to the location of various topographical elements, floodplains, roads, and water bodies using GIS (Geographic Information Systems). Vulnerable facilities were identified by comparing their location to possible hazard events. For example, all the structures within the 100-year and 500-year floodplains were identified and used in conducting the potential loss analysis for flooding.

Calculating the Potential Loss

The next step in completing the loss estimation involved assessing the level of damage from a hazard event on structures in Seabrook. For the purpose of estimating general losses, the total value for all structures in Seabrook in 2017, residential, commercial and industrial of was used, for a total of $2,717,305,110. For the purpose of estimating losses from flooding, an estimate of $350,000 per structure was used.

The damage estimates are divided into two categories based on hazard types: hazards that are location specific (e.g. flooding), and hazards that could affect all areas of Seabrook equally, such as extreme temperatures. Damage estimates from hazards that could affect all of Seabrook equally are much rougher estimates, based on percentages of the total assessed value of all structures in the community. Damage estimates from hazards with a specific location are derived from the assessed values of the parcels within the hazard area. Assessing and tax map data were used to determine buildings at risk. After identifying the parcels and buildings that are at risk, the next step was to calculate a damage estimate for each potential hazard area. The following discussion summarizes the potential loss estimates due to natural hazard events.

Flooding – Special Flood Hazard Zones - The average replacement value was calculated by adding up the assessed values of all structures in the 100 and 500-year floodplains. Because of the scale and resolution of the FIRM maps and imagery this is only an approximation of the total structures located within the 100 and 500-year floodplains. The Federal Emergency Management Agency (FEMA) has developed a process to calculate potential loss for structures during flood. The potential loss was calculated by multiplying the replacement value by the percent of damage expected from the hazard event. Residential and non-residential structures were combined.

The costs for repairing or replacing bridges, railroads, power lines, telephone lines, and contents of structures are not included in this estimate. In addition, the figures used were based on buildings which are one or two stories high with basements. The following calculation is based on eight-foot flooding and assumes that, on average, one or two-story buildings with basements receive 49% damage (Understanding Your Risks, Identifying Hazards and Estimating Losses, FEMA page 4-13):

Potential Structure Damage: 49%
Approximately 532 structures estimated at $186,200,000 = $91,238,000 potential damage.

The following calculation is based on four-foot flooding and assumes that, on average, one or two-story buildings with basements receive 28% damage (Understanding Your Risks, Identifying Hazards and Estimating Losses, FEMA page 4-13):

Potential Structure Damage: 28%
Approximately 532 structures estimated at $186,200,000 = $52,136,000 potential damage.

The following calculation is based on two-foot flooding and assumes that, on average, one or two-story buildings with basements receive 20% damage (Understanding Your Risks, Identifying Hazards and Estimating Losses, FEMA page 4-13):

Potential Structure Damage: 20%
Approximately 532 structures assessed at $186,200,00 = $37,240,000 potential damage

Several areas of Seabrook were identified as having high risk of flooding. These areas are identified in Chapter III and Map 2: Past and Future Hazards. Potential losses were also calculated for these at-risk areas in the same manner as those structures in the 100 and 500 - year floodplains. These assessments are only based on the potential damages to building within the identified at-risk areas.

Table 7: Percentages of structural and content damage estimated, based on the assessed value of a flooded parcel. Also shows the functional downtime and displacement time for each flood event.

Flood Depth	One-foot	Two-foot	Four-foot
% Structural Damage: Buildings	15%	20%	28%
% Structural Damage: Mobile Homes	44%	63%	78%
% Contents Damage: Buildings	22.5%	30%	42%
% Contents Damage: Mobile Homes	30%	90%	90%
Flood Functional Downtime: Buildings	15 days	20 days	28 days
Flood Functional Downtime: Mobile Homes	30 days	30 days	30 days
Flood Displacement Time: Buildings	70 days	110 days	174 days
Flood Displacement Time: Mobile Homes	302 days	365 days	365 days

Hurricane/ High Wind Events

Hurricane - Hurricanes do affect the Northeast coast periodically. Since 1900, 2 hurricanes have made landfall in the State of New Hampshire. Due to the coastal location of the Town of Seabrook, hurricanes and storm surges present a real hazard to the community. Even degraded hurricanes or tropical storms could still cause significant damage to the structures and infrastructure of the Town of Seabrook. The assessed value of all residential and commercial structures for the Town of Seabrook in 2017 is $2,717,305, 110. Assuming 1% to 5% damage, a hurricane could result in $27,1173,051 to $135,865,255 in structure damage.

Tornado - Tornadoes are relatively uncommon natural hazards in New Hampshire. On average, about six touch downs each year. Damage largely depends on where the tornado strikes. If is strikes an inhabited area, the impact could be severe. In the State of New Hampshire, the total cost of tornadoes between 1950 and 1995 was $9,071,389 (The Disaster Center). The assessed value of all residential and commercial structures for the Town of Seabrook in 2017 is $2,717,305, 110. Assuming 1% to 5% damage, a tornado could result in $27,1173,051 to $135,865,255 in structure damage.

Severe Lightning - The amount of damage caused by lightning will vary according to the type of structure hit and the type of contents inside. There is now record of monetary damages inflicted in the Town of Seabrook from lightning strikes.

Severe Winter Weather

Heavy Snowstorms - Heavy snowstorms typically occur during January and February. New England usually experiences at least one or two heavy snow storms with varying degrees of severity each year. Power outages, extreme cold and impacts to infrastructure are all effects of winter storms that have been felt in Seabrook in the past. All these impacts are a risk to the community, including isolation, especially of the elderly, and increased traffic accidents. Damage caused by this type of hazard varies according to wind velocity, snow accumulation and duration. The assessed value of all residential and commercial structures for the Town of Seabrook in 2017 is $2,717,305, 110. Assuming 1% to 5% damage, a heavy snowstorm could result in $27,1173,051 to $135,865,255 in structure damage.
http://www.rpc-nh.org/application/files/8014/6920/2321/Seabrook_Vulnerability_Assessment.pdf

Ice Storms - Ice storms often cause widespread power outages by downing power lines, making power lines at risk in Seabrook. They can also cause severe damage to trees. In 1998, an ice storm inflicted $12,466,202 worth of damage to New Hampshire and PSNH estimated the cost of power restoration effort estimated at $75 million for the state of NH. Ice storms in Seabrook could be expected to cause damage ranging from a few thousand dollars to millions of dollars, depending on the severity of the storm.

Wildfire

The risk of fire is difficult to predict based on location. Forest fires, and fires involving dune grass and phragmites are more likely to occur during periods of drought. The areas identified as at risk to wildfire are shown on Map 2.

Earthquakes

Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines and are often associated with landslides and flash floods. Four earthquakes in New Hampshire between 1924-1989 had a magnitude of 4.2 or more. Two of these occurred in Ossipee, one west of Laconia, and one near the Quebec border. If an earthquake were to impact the Town of Seabrook, underground lines would be susceptible. In addition, buildings that are not built to a high seismic design level would be susceptible to structural damage. The assessed value of all residential and commercial structures for the Town of Seabrook in 2017 is $2,717,305, 110. Assuming 1% to 5% damage, a heavy snowstorm could result in $27,1173,051 to $135,865,255 in structure damage.

Sea Level Rise, Coastal Storm Surge

In addition to the potential of flood damage and high wind damage discussed above, sea level rise and coastal storm surge could damage building and infrastructure along beach, harbor, and tidal rivers and streams in Seabrook. In 2015, the Rockingham Planning Commission completed a Vulnerability Assessment for the Town of Seabrook of impacts associated with projected sea level rise and coastal storm surge. Using the projection of 6.3 feet sea level rise by the year 2100, the Assessment identified 1,187 parcels at risk of flooding, involving 850 acres of upland, 10 miles of roadways, 9 critical facilities, and 27 units of infrastructure.

Drought

Extended drought can impact municipal water supplies, private drinking wells, and make vegetated areas more susceptible to wildfire (see above). The Town has no record of monetary damage in related to drought.

Extreme Temperatures

The Committee determined that all parts of town are at risk of impacts associated with extreme heat and cold. Young and elderly populations are particularly vulnerable and the EMD can direct vulnerable residents to heating and cooling stations.

CHAPTER VI – EXISTING HAZARD MITIGATION PROGRAMS

The next step involves identifying existing mitigation strategies for the hazards likely to affect the town and evaluate their effectiveness. This section outlines those programs and recommends improvements and changes to these programs to ensure the highest quality emergency service possible.

Table 8: Existing Hazard Mitigation Programs for the Town of Seabrook

Existing Protection	Description/ Area Covered	Responsible Local Agent	Effectiveness/Comments
2017 Zoning Ordinance	Town Wide	Code Enforcement Officer	Reviewed and updated annually, includes wetlands and aquifer protection regulations.
2016 Town Building Code	NH State Building Code	Building Inspector	Reviewed and updated as needed
Flood Warning System	Town Wide, Siren	Fire/Police Departments	Good, addition of Reverse 911 would improve system.
Hazardous Materials Plan/ Team	Seacoast "START" Plan	Fire Chief	Annual training makes this program very effective. Improvements reviewed and updated annually.
2018 Emergency Operations Plan	All Hazards	Fire/Police Departments	Good, recently completed
Seabrook Radiological Plan	Town Wide	Emergency Management Director	This plan is important due to proximity to the nuclear power plant and is reviewed annually.
Emergency Services: Police Department	Town Wide	Police Chief	Annual training and meetings make this program more effective. Program is reviewed and updated annually or as needed.
Emergency Services: Fire Department	Town Wide	Fire Chief	The fire department continues extensive training to ensure effective emergency response. Task is reviewed and updated annually or as needed.
Emergency Services: EMS	Town Wide	Fire Chief	Good. Program is reviewed and updated annually or as needed.
Public Works	Town Wide	Department of Public Works	Effective culvert and storm water management will help hinder flooding potential in town. Program is reviewed and updated annually or as needed.

Existing Protection	Description/ Area Covered	Responsible Local Agent	Effectiveness/Comments
2011 Town Master Plan	Town Wide, 2003	Planning Board	Is updated as needed to reflect growth trends and planning board/towns vision. Includes chapter on Climate Change and Adaptation Planning
NFIP Floodplain Ordinance and participation	Town Wide	Zoning Officer	Reviewed annually for state and federal compliance and should follow recommendations found on page 19 "Potential Administrative Techniques to Minimize Flood Losses in Seabrook."
Adaptation Strategies to Protect Areas of Increased risk from Coastal Flooding Due to Climate Change Plan	Beach District, Coastal Flooding Area up to the 15' contour	Planning Board, Selectmen	Need to review and incorporate implementation strategies found in plan.
Beach Precinct Zoning Regulations	Beach Village District	Beach Precinct Building Inspector	Is an effective way to help mitigate future coastal storm damage. Is reviewed and updated annually.
2018 Capital Improvement Program	Town Wide	Planning Board	Updated on an annual basis and should correspond with mitigation actions in this plan. Is reviewed and updated annually.
Catch basin, drainage way maintenance program	Town Wide	Department of Public Works	Good program, done yearly to ensure proper drainage in town. Is reviewed and updated annually.
Harbor Master	Seabrook Harbor	NH Division of Ports and Harbors of the Pease Development Authority	Harbor master ensures effective sea navigation to and from the harbor. No improvements needed.
Emergency Back-up Power	Fire Chief	Average	Shelters Need Generators. Improvements needed for effective response.
2015 Vulnerability Report on Sea Level Rise and Coastal Storm Surge Flooding	Town Wide	Planning Board, Selectmen	Includes assessment of infrastructure and areas at risk of flooding

Existing Protection	Description/ Area Covered	Responsible Local Agent	Effectiveness/Comments
Beach Management Plan	North Beach, Hooksett Street to Hampton town line	DPW/Seabrook Beach Commissioners	Update needed
Code Red Reverse 911	Town Wide	Police and Fire Departments	
MS4 Stormwater Management Program	Town Wide	DPW	In compliance with EPA MS4 permit requirements
Dune Restoration Project	Seabrook beach	Conservation Commission	
Groundwater Management Plan	Water supply areas	Water Department	
Public Education and Outreach via social media	Town Wide via cable access TV, Town website, Facebook, Twitter	Town Departments	Each Town Department manages their own social media accounts to inform residents of hazard mitigation

CHAPTER VIII – MITIGATION ACTIONS

The Action Plan was developed by analyzing the existing Town programs, the proposed improvements and changes to these programs. Additional programs were also identified as potential mitigation strategies. These potential mitigation strategies were ranked in five categories according to how they accomplished each item:

- Prevention
- Property Protection
- Structural Protection
- Emergency Services
- Public Information and Involvement

Table 9: List of Hazard Mitigation Strategies or Actions

Mitigation Strategies or Action	Hazard(s) Mitigated	Description	Type of Activity	Status 2018: New/Completed/ Deferred /Removed
Review Existing Infrastructure, Continue Culvert Maintenance Management Program	All Hazards	Evaluate existing infrastructure (Roads, Bridges, Storm water Management Devices, Etc.) for repair replacement needs. Emphasis on infrastructure critical during hazard situation (e.g. evacuation route, culverts). Continue culvert maintenance program	Prevention/ Property Protection	Completed and ongoing
Repair/ Replace Infrastructure	All Hazards	Implement schedule for repair or replacement of infrastructure in need. Incorporate into CIP or as warrant articles	Structural	Completed

Mitigation Strategies or Action	Hazard(s) Mitigated	Description	Type of Activity	Status 2018: New/Completed/ Deferred /Removed
Increase Emergency Shelters	All Hazards	Assess current evacuation/emergency shelter capacity. Establish additional shelters as needed	Emergency Services/ Prevention	Completed
Update/Install Generators in Shelters	All Hazards	Provide back-up power generators for all evacuation/emergency shelters	Emergency Services/ Prevention	Deferred - Beach Precinct shelter needs a generator
Update Emergency Operations Plan	All Hazards	Update the EOP to update emergency management personnel's roles	Emergency Services/ Prevention	Completed
Reverse 911/Code Red	All Hazards	Install Reverse 911 system to provide emergency contact to all Town residents	Prevention/ Public Information	Completed
Update CIP	All Hazards	Update CIP to address Seabrook Emergency Department Hazard equipment needs	Prevention	Completed, updated annually
Evaluate Existing Hazard Training and Drills	All Hazards	Review existing training and drilling schedule. Establish drill schedule that includes all involved Seabrook departments	Prevention	Completed, training occurs twice a year
North side of Fisherman's Coop Bank Stabilization Project	Flooding/Coastal Storms/Earthquakes/Severe Winter Weather	Hillside banks are eroding into the main navigable way of Hampton Harbor. Sink holes are also found in this location which is a Town Park. Bank erosion is also impacting Hampton water lines negatively	Structural/ Prevention	In process, funding authorized

Mitigation Strategies or Action	Hazard(s) Mitigated	Description	Type of Activity	Status 2018: New/Completed/ Deferred /Removed
Stormwater Pump Station	Flooding	Half of the beach streets along the beach district depend on a pump station for pumping storm water out of the beach area vicinity. A back-up generator or new pipe design, pipe route is needed to ensure effective storm water flow out of the beach district area especially during heavy rain events	Structural/ Prevention	Completed
Catch Basin Replacement (Beach District)	Flooding	The Town is trying to replace the catch basins within the beach district to provide deeper sumps and better functionality, but additional help may increase the town's resiliency	Structural/ Prevention	Completed
Implementation of adaptation strategies from the plan, "Adaptation Strategies to Protect Areas of Increased Risk from Coastal Flooding Due to Climate Change Seabrook, NH" developed for the town by the Rockingham Planning Commission	Storm Surge/ Flooding/Sea Level Rise	The plan includes regulatory and non-regulatory approaches for mitigating the impacts the Town is likely to experience from sea level rise and storm surge	Prevention	Deferred – Climate Change Adaptation Master Plan chapter has been drafted

Mitigation Strategies or Action	Hazard(s) Mitigated	Description	Type of Activity	Status 2018: New/Completed/ Deferred /Removed
Build flood protective berm around Seabrook Elementary School to protect against current and future flooding	Flooding	A 24- inch rise in sea level will cause extensive flooding around this critical facility and potential emergency shelter	Structural/ Prevention	Deferred
Education and outreach regarding Seabrook's proximity to an earthquake zone/fault line	Earthquake	Post information on social media and provide brochures or other forms of notice to Towns people regarding the risks associated by living proximity to an earthquake zone and or fault line	Public Information	Completed
Noyes Pond Dam Replacement/Rebuild	Flooding	During 2007 storm Noyes Pond Dam failed. Due to this a sewer pump station on Centennial Street flooded and is at great risk to future flooding events	Structural	Deferred
I-95 Culvert Replacement on West side of Folly Mill Road	Flooding	Larger culvert needed to mitigate flooding to properties downstream	Structural	Deferred
Acquire new sources of municipal water supply	Drought/Extreme Heat	Drought and extreme heat result in increased demands on municipal water supply	Prevention	New
Tree Trimming Program	Hurricane/High Wind Events	Identification and management of hazard trees to prevent damage to structures and utilities	Prevention	New

Mitigation Strategies or Action	Hazard(s) Mitigated	Description	Type of Activity	Status 2018: New/Completed/ Deferred /Removed
Work with NHDOT to elevate portions of Rt. 286 due to flooding by storm surge, and evaluate structural integrity of bridge on Rt. 286	Flooding, Hurricane	Rt. 286 is a primary evacuation route from Seabrook Beach. The road is prone to flooding during storms and high tide events	Prevention/Emergency Services/Structural	New

CHAPTER VIII. FEASIBILITY AND PRIORITIZATION OF PROPOSED MITIGATION STRATEGIES

The goal of each strategy or action is reduction or prevention of damage from a hazard event. To determine their effectiveness in accomplishing this goal, a set of criteria was applied to each proposed strategy. A set of questions developed by the Committee that included the STAPLEE method was developed to rank the proposed mitigation actions. The STAPLEE method analyzes the Social, Technical, Administrative, Political, Legal, Economic and Environmental aspects of a project and is commonly used by public administration officials and planners for making planning decisions. The following questions were asked about the proposed mitigation strategies identified in Table 9.

- Does it reduce disaster damage?
- Does it contribute to other goals?
- Does it benefit the environment?
- Does it meet regulations?
- Will historic structures be saved or protected?
- Does it help achieve other community goals?
- Could it be implemented quickly?

STAPLEE criteria:

- **Social**: Is the proposed strategy socially acceptable to the community? Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- **Technical**: Will the proposed strategy work? Will it create more problems than it solves?
- **Administrative**: Can the community implement the strategy? Is there someone to coordinate and lead the effort?
- **Political**: Is the strategy politically acceptable? Is there public support both to implement and to maintain the project?
- **Legal**: Is the community authorized to implement the proposed strategy? Is there a clear legal basis or precedent for this activity?
- **Economic**: What are the costs and benefits of this strategy? Does the cost seem reasonable for the size of the problem and the likely benefits?
- **Environmental**: How will the strategy impact the environment? Will the strategy need environmental regulatory approvals?

Each proposed mitigation strategy was evaluated using the above criteria and assigned a score (Good = 3, Average = 2, Poor = 1) based on the above criteria. An evaluation chart with total scores for each strategy can be found in the collection of individual tables under Table 10a – 10p.

Table 10a: Generator in Beach Precinct Shelter

Criteria	Score
Does it reduce disaster damage?	1
Does it contribute to other goals?	3
Does it benefit the environment?	1
Does it meet regulations?	3
Will historic structures be saved or protected?	1
Does it help achieve other community goals?	2
Could it be implemented quickly?	3
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	3
Total	**32**

Table 10b: Implementation of Adaptation Plan Strategies

Criteria	Score
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	3
Does it help achieve other community goals?	3
Could it be implemented quickly?	2
S: Is it Socially acceptable?	2
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	3
Total	**39**

Table 10c: Protective Berm around Seabrook Elementary School

Criteria	Score
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	2
Does it meet regulations?	3
Will historic structures be saved or protected?	3
Does it help achieve other community goals?	3
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	1
Total	**37**

Table 10d: Noyes Pond Dam Replacement/Rebuild

Criteria	Score
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	3
Does it help achieve other community goals?	3
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	1
Total	**38**

Table 10e: Culvert Replacement West Side of Folly Mill Road

Criteria	Score
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	3
Will historic structures be saved or protected?	2
Does it help achieve other community goals?	3
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	1
A: Is it Administratively workable?	1
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	1
E: Is it Economically beneficial?	1
E: Are other Environmental approvals required?	1
Total	**29**

Table 10f: Acquire New Sources of Municipal Water Supply

Criteria	Score
Does it reduce disaster damage?	2
Does it contribute to other goals?	3
Does it benefit the environment?	2
Does it meet regulations?	3
Will historic structures be saved or protected?	1
Does it help achieve other community goals?	3
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	1
Total	**34**

Table 10g: Elevate Portions of Route 286

Criteria	Score
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	2
Will historic structures be saved or protected?	3
Does it help achieve other community goals?	3
Could it be implemented quickly?	1
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	2
A: Is it Administratively workable?	2
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	3
E: Are other Environmental approvals required?	1
Total	**34**

Table 10h: Tree Trimming Program

Criteria	Score
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	3
Does it meet regulations?	1
Will historic structures be saved or protected?	2
Does it help achieve other community goals?	3
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	3
Total	**36**

CHAPTER IX. IMPLEMENTATION SCHEDULE FOR PRIORITY MITIGATION STRATEGIES

This step involves developing an action plan that outlines who is responsible for implementing each of the prioritized strategies determined in the previous step, as well as when and how the actions will be implemented. The following questions were asked to develop an implementation schedule for the identified priority mitigation strategies:

WHO? Who will lead the implementation efforts? Who will put together funding requests and applications?

HOW? How will the community fund these projects? How will the community implement these projects? What resources will be needed to implement these projects?

WHEN? When will these actions be implemented, and in what order?

Table 11 is the Action Plan. In addition to the prioritized mitigation projects, Table 11 includes the responsible party (WHO), how the project will be supported (HOW), and what the timeframe is for implementation of the project (WHEN). Also included is a cost estimate for each project if available.

Table 11: Action Plan for Proposed Mitigation Actions

STAPLEE Score	Project	Responsibility/ Oversight	Funding/ Support	Estimated Cost	Timeframe
39	Implement strategies from Town's Coastal Adaptation Plan	Board of Selectmen/Planning Board/DPW	Town/HMPG	Unknown	Medium-term 2-3 years
38	Noyes Pond Dam rebuild/replace	Board of Selectmen/Conservation Commission	Town/HMPG	$400K	Long-term 3-5 years
37	Protective berm around Elementary School	School Board/Board of Selectmen	Town/HMPG	$350K	Long-term 3-5 years
36	Establish tree trimming program	DPW/Utilities	Town/Utilities	Unknown	Short-term 1 year or less
34	Acquire new sources of municipal water supply	Board of Selectmen/Water Department	Town/NHDES	Unknown	Long-term 3-5 years

STAPLEE Score	Project	Responsibility/ Oversight	Funding/ Support	Estimated Cost	Timeframe
34	Elevate Portions of Rt. 286	NHDOT/DPW	State	Unknown	Long-term 3-5 years
32	Purchase generator for Beach Village District Shelter	SBVD Commissioners/EMD	Town/HMPG	$40K	Short-term 1 year or less

CHAPTER X. MONITORING, EVALUATING AND UPDATING THE PLAN

Incorporating the Plan into Existing Planning Mechanisms

Upon completion and approval by FEMA and the State of New Hampshire, the Plan will be adopted as a standalone document of the Town and as an appendix of the Town's Emergency Operations Plan (EOP). An update of the EOP is continuing; future updates to the EOP will incorporate the Plan as a referenced appendix, but the two plans will always be printed as separated documents. The EOP is subject to annual review.

In the future, the Hazard Mitigation Plan will be consulted when the Town updates its Capital Improvement Program (CIP). The Capital Improvements Committee is responsible for updating the CIP annually, and will review the Action Plan, as it has done before, during each update. This committee in conjunction with Seabrook Emergency Management will determine what items can and should be added to the CIP based on the Town's annual budget and possible sources of other funding. Portions of this plan should be referred to when updates to the towns Master Plan takes place. Considerations about future land use and proximity to current and potential hazard areas need to be inherently part of the planning process. NH RSA 674:2 (d) gives towns the authority to include a natural hazards section, which documents the physical characteristics, severity, and extent of any potential natural hazards to the community, within the framework of a Master Plan.

Monitoring, Evaluating and Updating the Plan

Recognizing that many mitigation projects are continual, and that while in the implementation stage communities may suffer budget cuts, experience staff turnover, or projects may fail altogether, a good plan needs to provide for periodic monitoring and evaluation of its successes and failures and allow for updates of the Plan where necessary.

To track progress and update the Mitigation Strategies identified in the Action Plan, it is recommended that the Town revisit the Plan annually, or after a hazard event. If it is not realistic or appropriate to revise the Plan every year, then the Plan will be revisited no less than every five years per FEMA requirements. The Emergency Management Director is responsible for initiating this review with members of the Town that are appropriate including members of the public. In keeping with the process of adopting the 2018 Plan Update and per NH State RSA 91-A, a public meeting to receive public comment on Plan maintenance and updating will be held during any review of the Plan. This publicly noticed meeting (via town website, and postings in the town office, library, or local newspaper) will allow for members of the community not involved in developing the Plan to provide input and comments each time the Plan is revised. The final revised Plan will be adopted by the Board of Selectmen appropriately, at a second publicly noticed meeting.

Changes should be made to the Plan to accommodate for projects that have failed or are not considered feasible after a review for their consistency with STAPLEE, the timeframe, the community's priorities, and funding resources. Priorities that were not ranked high, but identified as potential mitigation strategies, should be reviewed as well during the monitoring and update of this Plan to determine feasibility of future implementation.

APPENDIX A:
SUMMARY OF HAZARD MITIGATION STRATEGIES

I. RIVERINE MITIGATION

A. PREVENTION - Prevention measures are intended to keep the problem from occurring in the first place, and/or keep it from getting worse. Future development should not increase flood damage. Building, zoning, planning, and/or code enforcement officials usually administer preventative measures.

1. Planning and Zoning - Land use plans are put in place to guide future development, recommending where - and where not - development should occur. Sensitive and vulnerable lands can be designated for uses that would not be incompatible with occasional flood events - such as parks or wildlife refuges. A Capital Improvements Program can recommend the setting aside of funds for public acquisition of these designated lands. The zoning ordinance can regulate development in these sensitive areas by limiting or preventing some or all development - for example, by designating floodplain overlay, conservation, or agricultural districts.

2. Open Space Preservation - Preserving open space is the best way to prevent flooding and flood damage. Open space preservation should not, however, be limited to the flood plain, since other areas within the watershed may contribute to controlling the runoff that exacerbates flooding. Land Use and Capital Improvement Plans should identify areas to be preserved by acquisition and other means, such as purchasing easements. Aside from outright purchase, open space can also be protected through maintenance agreements with the landowners, or by requiring developers to dedicate land for flood flow, drainage and storage.

3. Floodplain Development Regulations - Floodplain development regulations typically do not prohibit development in the special flood hazard area, but they do impose construction standards on what is built there. The intent is to protect roads and structures from flood damage and to prevent the development from aggravating the flood potential. Floodplain development regulations are generally incorporated into subdivision regulations, building codes, and floodplain ordinances, which either stand-alone or are contained within a zoning ordinance.

Subdivision Regulations: These regulations govern how land will be divided into separate lots or sites. They should require that any flood hazard areas be shown on the plat, and that every lot has a buildable area that is above the base flood elevation.

Building Codes: Standards can be incorporated into building codes that address flood proofing for all new and improved or repaired buildings.

Floodplain Ordinances: Communities that participate in the National Flood Insurance Program are required to adopt the minimum floodplain management regulations, as developed by FEMA. The regulations set minimum standards for subdivision regulations and

building codes. Communities may adopt more stringent standards than those set forth by FEMA.

4. Storm water Management - Development outside of a floodplain can contribute significantly to flooding by covering impervious surfaces, which increases storm water runoff. Storm water management is usually addressed in subdivision regulations. Developers are typically required to build retention or detention basins to minimize any increase in runoff caused by new or expanded impervious surfaces, or new drainage systems. Generally, there is a prohibition against storm water leaving the site at a rate higher than it did before the development. One technique is to use wet basins as part of the landscaping plan of a development. It might even be possible to site these basins based on a watershed analysis. Since detention only controls the runoff rates and not volumes, other measures must be employed for storm water infiltration - for example, swales, infiltration trenches, vegetative filter strips, and permeable paving blocks.

5. Drainage System Maintenance - Ongoing maintenance of channel and detention basins is necessary if these facilities are to function effectively and efficiently over time. A maintenance program should include regulations that prevent dumping in or altering watercourses or storage basins; regrading and filling should also be regulated. Any maintenance program should include a public education component, so that the public becomes aware of the reasons for the regulations. Many people do not realize the consequences of filling in a ditch or wetland or regrading their yard without concern for runoff patterns.

B. PROPERTY PROTECTION - Property protection measures are used to modify buildings subject to flood damage, rather than to keep floodwaters away. These may be less expensive to implement, as they are often carried out on a cost-sharing basis. In addition, many of these measures do not affect a building's appearance or use, which makes them particularly suitable for historical sites and landmarks.

1. Relocation - Moving structures out of the floodplain is the surest and safest way to protect against damage. Relocation is expensive, however, so this approach will probably not be used except in extreme circumstances. Communities that have areas subject to severe storm surges, ice jams, etc. might want to consider establishing a relocation program, incorporating available assistance.

2. Acquisition - Acquisition by a governmental entity of land in a floodplain serves two main purposes: (1) it ensures that the problem of structures in the floodplain will be addressed; and (2) it has the potential to convert problem areas into community assets, with accompanying environmental benefits. Acquisition is more cost effective than relocation in those areas that are subject to storm surges, ice jams, or flash flooding. Acquisition, followed by demolition, is the most appropriate strategy for those buildings that are simply too expensive to move, as well as for dilapidated structures that are not worth saving or protecting. Relocation can be expensive; however, there are government grants and loans that can be applied toward such efforts.

3. Building Elevation - Elevating a building above the base flood elevation is the best on-site protection strategy. The building could be raised to allow water to run underneath it, or fill could be brought in to elevate the site on which the building sits. This approach is cheaper than relocation and tends to be less disruptive to a neighborhood. Elevation is required by law for new and substantially improved residences in a floodplain and is commonly practiced in flood hazard areas nationwide.

4. Flood Proofing - If a building cannot be relocated or elevated, it may be flood proofed. This approach works well in areas of low flood threat. Flood proofing can be accomplished through barriers to flooding, or by treatment to the structure itself.

Barriers: Levees, floodwalls and berms can keep floodwaters from reaching a building. These are useful, however, only in areas subject to shallow flooding.

Dry Flood proofing: This method seals a building against the water by coating the walls with waterproofing compounds or plastic sheeting. Openings, such as doors, windows, etc. are closed either permanently with removable shields or with sandbags.

Wet Flood proofing: This technique is usually considered a last resort measure, since water is intentionally allowed into the building to minimize pressure on the structure. Approaches range from moving valuable items to higher floors to rebuilding the floodable area. An advantage over other approaches is that simply by moving household goods out of the range of floodwaters, thousands of dollars can be saved in damages.

5. Sewer Backup Protection - Storm water overloads can cause backup into basements through sanitary sewer lines. Houses that have any kind of connection to a sanitary sewer system - whether it is downspouts, footing drain tile, and/or sump pumps, can be flooded during a heavy rain event. To prevent this, there should be no such connections to the system, and all rain and ground water should be directed onto the ground, away from the building. Other protections include:

- Floor drain plugs and floor drain standpipe, which keep water from flowing out of the lowest opening in the house.

- Overhead sewer - keeps water in the sewer line during a backup.

- Backup valve - allows sewage to flow out while preventing backups from flowing into the house.

6. Insurance - Above and beyond standard homeowner insurance, there is other coverage a homeowner can purchase to protect against flood hazard. Two of the most common are National Flood Insurance and basement backup insurance.

National Flood Insurance: When a community participates in the National Flood Insurance Program, any local insurance agent is able to sell separate flood insurance policies under

rules and rates set by FEMA. Rates do not change after claims are paid because they are set on a national basis.

Basement Backup Insurance: National Flood Insurance offers an additional deductible for seepage and sewer backup, provided there is a general condition of flooding in the area that was the proximate cause of the basement getting wet. Most exclude damage from surface flooding that would be covered by the NFIP.

C. NATURAL RESOURCE PROTECTION - Preserving or restoring natural areas or the natural functions of floodplain and watershed areas provide the benefits of eliminating or minimizing losses from floods, as well as improve water quality and wildlife habitats. Parks, recreation, or conservation agencies usually implement such activities. Protection can also be provided through various zoning measures that are specifically designed to protect natural resources.

1. Wetlands Protection - Wetlands are capable of storing large amounts of floodwaters, slowing and reducing downstream flows, and filtering the water. Any development that is proposed in a wetland is regulated by either federal and/or state agencies. Depending on the location, the project might fall under the jurisdiction of the U.S. Army Corps of Engineers, which in turn, calls upon several other agencies to review the proposal. In New Hampshire, the N.H. Wetlands Board must approve any project that impacts a wetland. And, many communities in New Hampshire also have local wetland ordinances. Generally, the goal is to protect wetlands by preventing development that would adversely affect them. Mitigation techniques are often employed, which might consist of creating a wetland on another site to replace what would be lost through the development. This is not an ideal practice, however, since it takes many years for a new wetland to achieve the same level of quality as an existing one.

2. Erosion and Sedimentation Control - Controlling erosion and sediment runoff during construction and on farmland is important, since eroding soil will typically end up in downstream waterways. And, because sediment tends to settle where the water flow is slower, it will gradually fill in channels and lakes, reducing their ability to carry or store floodwaters. Practices to reduce erosion and sedimentation have two principal components: (1) minimize erosion with vegetation and; (2) capture sediment before it leaves the site. Slowing the runoff increases infiltration into the soil, thereby controlling the loss of topsoil from erosion and the resulting sedimentation. Runoff can be slowed by vegetation, terraces, contour strip farming, no-till farm practices, and impoundments (such as sediment basins, farm ponds, and wetlands).

3. Best Management Practices - Best Management Practices (BMPs) are measures that reduce nonpoint source pollutants that enter waterways. Nonpoint source pollutants are carried by storm water to waterways, and include such things as lawn fertilizers, pesticides, farm chemicals, and oils from street surfaces and industrial sites. BMPs can be incorporated into many aspects of new developments and ongoing land use practices. In New Hampshire, the Department of Environmental Services has developed best management practices for a range of activities, from farming to earth excavations.

D. EMERGENCY SERVICES - Emergency services protect people during and after a flood. Many communities in New Hampshire have emergency management programs in place, administered by an emergency management director (very often the local police or fire chief).

1. Flood Warning - On large rivers, the National Weather Service handles early recognition. Communities on smaller rivers must develop their own warning systems. Warnings may be disseminated in a variety of ways, such as sirens, radio, television, mobile public-address systems, or door-to-door contact. It seems that multiple or redundant systems are the most effective, giving people more than one opportunity to be warned.

2. Flood Response - Flood response refers to actions that are designed to prevent or reduce damage or injury, once a flood threat is recognized. Such actions and the appropriate parties include:

- activating the emergency operations center (emergency director)
- sandbagging designated areas (public works department)
- closing streets and bridges (police department)
- shutting off power to threatened areas (public service)
- releasing children from school (school district)
- ordering an evacuation (selectmen/city council/emergency director)
- opening evacuation shelters (churches, schools, Red Cross, municipal facilities)

These actions should be part of a flood response plan, which should be developed in coordination with the persons and agencies that share the responsibilities. Drills and exercises should be conducted so that the key participants know what they are supposed to do.

3. Critical Facilities Protection - Protecting critical facilities is vital, since expending efforts on these facilities can draw workers and resources away from protecting other parts of town. Buildings or locations vital to the flood response effort:

- emergency operations centers
- police and fire stations
- hospitals
- highway garages
- selected roads and bridges
- evacuation routes
- Buildings or locations that, if flooded, would create secondary disasters
- hazardous materials facilities
- water/wastewater treatment plants
- schools
- nursing homes

All such facilities should have their own flood response plan that is coordinated with the community's plan. Nursing homes, other public health facilities, and schools will typically be required by the state to have emergency response plans in place.

4. Health and Safety Maintenance - The flood response plan should identify appropriate measures to prevent danger to health and safety. Such measures include:

- Patrolling evacuated areas to prevent looting.
- Providing safe drinking water.
- Vaccinating residents for tetanus.
- Clearing streets.
- Cleaning up debris.

The plan should also identify which agencies will be responsible for carrying out the identified measures. A public information program can be helpful to educate residents on the benefits of taking health and safety precautions.

Structural Project - Structural projects are used to prevent floodwaters from reaching properties. These are all man-made structures, and can be grouped into the six types, discussed below. The shortcomings of structural approaches are that:

- They can be very expensive.
- They disturb the land, disrupt natural water flows, and destroy natural habitats.
- They are built to an anticipated flood event and may be exceeded by a greater-than-expected flood.
- They can create a false sense of security.

Reservoirs - Reservoirs control flooding by holding water behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate the river downstream can handle.

Reservoirs are suitable for protecting existing development, and they may be the only flood control measure that can protect development close to a watercourse. They are most efficient in deeper valleys or on smaller rivers where there is less water to store. Reservoirs might consist of man-made holes dug to hold the approximate amount of floodwaters, or even abandoned quarries. As with other structural projects, reservoirs:

- are expensive;
- occupy a lot of land;
- require periodic maintenance;
- may fail to prevent damage from floods that exceed their design levels; and
- May eliminate the natural and beneficial functions of the floodplain.

Reservoirs should only be used after a thorough watershed analysis that identifies the most appropriate location and ensures that they would not cause flooding somewhere else. Because they are so expensive and usually involve more than one community, they are typically implemented with the help of state or federal agencies, such as the Army Corps of Engineers.

Levees/Floodwalls - Probably the best know structural flood control measure is either a levee (a barrier of earth) or a floodwall made of steel or concrete erected between the watercourse and the land. If space is a consideration, floodwalls are typically used, since levees need more space. Levees and floodwalls should be set back out of the floodway, so that they will not divert floodwater onto other properties.

Diversions - A diversion is simply a new channel that sends floodwater to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During flood flows, the stream spills over the diversion channel or tunnel, which carries the excess water to the receiving lake or river.

Diversions are limited by topography; they won't work everywhere. Unless the receiving water body is relatively close to the flood prone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive. Where topography and land use are not favorable, a more expensive tunnel is needed. In either case, care must be taken to ensure that the diversion does not create a flooding problem somewhere else.

Channel Modifications - Channel modifications include making a channel wider, deeper, smoother, or straighter. These techniques will result in more water being carried away, but, as with other techniques mentioned, it is important to ensure that the modifications do not create or increase a flooding problem downstream.

Dredging - Dredging is often cost-prohibitive because the dredged material must be disposed of somewhere else, and the stream will usually fill back in with sediment. Dredging is usually undertaken only on larger rivers, and then only to maintain a navigation channel.

Drainage modifications - These include man-made ditches and storm sewers that help drain areas where the surface drainage system is inadequate or where underground drainage ways may be safer or more attractive. These approaches are usually designed to carry the runoff from smaller, more frequent storms.

Storm Sewers - Mitigation techniques for storm sewers include installing new sewers, enlarging small pipes, street improvements, and preventing back flow. Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving body of water can absorb the increased flows without increased flooding.

In many developments, streets are used as part of the drainage system, to carry or hold water from larger, less frequent storms. The streets collect runoff and convey it to a receiving sewer, ditch, or stream. Allowing water to stand in the streets and then draining it slowly can be a more effective and less expensive measure than enlarging sewers and ditches.

Public Information - Public information activities are intended to advise property owners, potential property owners, and visitors about the hazards associated with a property, ways to

protect people and property from these hazards, and the natural and beneficial functions of a floodplain.

1. **Map Information -** Flood maps developed by FEMA outline the boundaries of the flood hazard areas. These maps can be used by anyone interested in a particular property to determine if it is flood-prone. These maps are available from FEMA, the NH Office of Emergency Management, the NH Office of State Planning, or your regional planning commission.

Outreach Projects - Outreach projects are proactive; they give the public information even if they have not asked for it. Outreach projects are designed to encourage people to seek out more information and take steps to protect themselves and their properties. Examples of outreach activities include:

- Mass mailings or newsletters to all residents.
- Notices directed to floodplain residents.
- Displays in public buildings, malls, etc.
- Newspaper articles and special sections.
- Radio and TV news releases and interview shows.
- A local flood proofing video for cable TV programs, and to loan to organizations.
- A detailed property owner handbook tailored for local conditions.
- Presentations at meetings of neighborhood groups.

Research has shown that outreach programs work, although awareness is not enough. People need to know what they can do about the hazards, so projects should include information on protection measures. Research also shows that locally designed and run programs are much more effective than national advertising.

Real Estate Disclosure - Disclosure of information regarding flood-prone properties is important if potential buyers are to be able to mitigate damage. Federally regulated lending institutions are required to advise applicants that a property is in the floodplain. However, this requirement needs to be met only five days prior to closing, and by that time, the applicant is typically committed to the purchase. State laws and local real estate practice can help by making this information available to prospective buyers early in the process.

Library - Your local library can serve as a repository for pertinent information on flooding and flood protection. Some libraries also maintain their own public information campaigns, augmenting the activities of the various governmental agencies involved in flood mitigation.

Technical Assistance - Certain types of technical assistance are available from the NFIP Coordinator, FEMA, and the Natural Resources Conservation District. Community officials can also set up a service delivery program to provide one-on-one sessions with property owners. An example of technical assistance is the flood audit, in which a specialist visits a property. Following the visit, the owner is provided with a written report, detailing the past and potential flood depths, and recommending alternative protection measures.

Environmental Education - Education can be a great mitigating tool, if people can learn what not to do before damage occurs. And the sooner the education begins, the better. Environmental education programs for children can be taught in the schools, park and recreation departments, conservation associations, or youth organizations. An activity can be as involved as course curriculum development or as simple as an explanatory sign near a river. Education programs do not have to be limited to children. Adults can benefit from knowledge of flooding and mitigation measures. And decision-makers, armed with this knowledge, can make a difference in their communities.

II. EARTHQUAKES

A. PREVENTIVE - Planning/zoning to keep critical facilities away from fault lines.
Planning, zoning and building codes to avoid areas below steep slopes or soils subject to liquefaction.
Building codes to prohibit loose masonry, overhangs, etc.

B. PROPERTY PROTECTION:
Acquire and clear hazard areas.
Retrofitting to add braces, remove overhangs.
Apply mylar to windows and glass surfaces to protect from shattering glass.
Tie down major appliances provide flexible utility connections.
Earthquake insurance riders.

C. EMERGENCY SERVICES - Earthquake response plans to account for secondary problems, such as fires and hazardous materials spills.

D. EMERGENCY SERVICES - Slope stabilization.

III. DAM FAILURE

A. PREVENTIVE:
Dam failure inundation maps.
Planning/zoning/open space preservation to keep area clear.
Building codes with flood elevation based on dam failure.
Dam safety inspections.
Draining the reservoir when conditions appear unsafe.

B. PROPERTY PROTECTION - Acquisition of buildings in the path of a dam breach flood. Flood insurance.

C. EMERGENCY SERVICES - Dam conditioning monitoring; warning and evacuation plans based on dam failure.

D. EMERGENCY SERVICES - Dam improvements, spillway enlargements. Remove unsafe dams.

IV. WILDFIRES

A. PREVENTIVE:

Zoning districts to reflect fire risk zones.
Planning and zoning to restrict development in areas near fire protection and water resources.
Requiring new subdivisions to space buildings, provide firebreaks, on-site water storage, wide roads multiple accesses.
Building code standards for roof materials, spark arrestors.
Maintenance programs to clear dead and dry bush, trees.
Regulation on open fires.

B. PROPERTY PROTECTION:

Retrofitting of roofs and adding spark arrestors.
Landscaping to keep bushes and trees away from structures.
Insurance rates based on distance from fire protection.

C. NATURAL RESOURCE PROTECTION - Prohibit development in high-risk areas.

D. EMERGENCY SERVICES - Fire Fighting

V. WINTER STORMS

A. PREVENTIVE - Building code standards for light frame construction, especially for wind-resistant roofs.

B. PROPERTY PROTECTION:

Storm shutters and windows
Hurricane straps on roofs and overhangs
Seal outside and inside of storm windows and check steals in spring and fall.
Family and/or company severe weather action plan & drills:
include a NOAA weather radio
designate a shelter area or location
keep a disaster supply kit, including stored food and water
keep snow removal equipment in good repair; have extra shovels, sand, rock, salt and gas
know how to turn off water, gas, and electricity at home or work

C. NATURAL RESOURCE PROTECTION - Maintenance program for trimming tree and shrubs

D. EMERGENCY SERVICES - Early warning systems/NOAA Weather Radio Evacuation Plans

APPENDIX B:
TECHNICAL AND FINANCIAL ASSISTANCE FOR HAZARD MITIGATION

Local Municipalities must have a FEMA-approved Hazard Mitigation Plan to be eligible for Hazard Mitigation Assistance Grants. Information on these grants may be found at: http://www.fema.gov/media-library-data/1424983165449-38f5dfc69c0bd4ea8a161e8bb7b79553/HMA_Guidance_022715_508.pdf

HAZARD MITIGATION GRANT PROGRAM (HMGP) - Authorized under Section 404 of the Stafford Act, the Hazard Mitigation Grant Program (HMGP) provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. Hazard Mitigation Grant Program funding is only available in States following a Presidential disaster declaration. Eligible applicants are:

- State and local governments
- Indian tribes or other tribal organizations
- Certain private non-profit organization

Individual homeowners and businesses may not apply directly to the program; however, a community may apply on their behalf. HMGP funds may be used to fund projects that will reduce or eliminate the losses from future disasters. Projects must provide a long-term solution to a problem, for example, elevation of a home to reduce the risk of flood damages as opposed to buying sandbags and pumps to fight the flood. In addition, a project's potential savings must be more than the cost of implementing the project. Funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage.

PRE-DISASTER MITIGATION GRANTS PROGRAM - The Pre-Disaster Mitigation (PDM) program provides technical and financial assistance to States and local governments for cost-effective pre-disaster hazard mitigation activities that complement a comprehensive mitigation program, and reduce injuries, loss of life, and damage and destruction of property. FEMA provides grants to States and Federally recognized Indian tribal governments that, in turn, provide sub-grants to local governments (to include Indian Tribal governments) for mitigation activities such as planning, and the implementation of projects identified through the evaluation of natural hazards.

FLOOD MITIGATION ASSISTANCE (FMA) PROGRAM - FEMA provides funding to assist States and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program (NFIP). There are three types of grants available under FMA: Planning, Project, and Technical Assistance Grants. FMA Planning Grants are available to States and communities to prepare Flood Mitigation Plans. NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project Grants. FMA Project Grants are available to States and NFIP participating communities to implement measures to reduce flood losses. Ten percent of the Project Grant is made available to States as a Technical Assistance Grant. These

funds may be used by the State to help administer the program. Communities receiving FMA Planning and Project Grants must be participating in the NFIP.

EMERGENCY MANAGEMENT PERFORMANCE GRANT

GUIDELINES - Emergency Management Performance Grant (EMPG Program) funding is available to local communities and eligible Agencies for projects that fall in FOUR general areas of Emergency Management: Planning activities; Training activities; Drills and Exercises; and Emergency Management Administration. Contact Liz Lufkin at NHHSEM, Elizabeth.Lufkin@dos.nh.gov, 603-223-3619 for assistance.

The following list of possible projects and activities is meant to guide you in selecting projects for an EMA Grant Submission. This list of suggested projects is not intended to be all-inclusive. Local communities or agencies may have other specific projects and activities that reflect local needs based on local capability assessments and local hazards.

Planning Activities may include:

- Develop a Hazard Mitigation Plan for your community.
- Prepare a hazard mitigation project proposal for submission to NHHSEM.
- Create, revise, or update Dam Emergency Action plans.
- Update your local Emergency Operations Plan (EOP). Consider updating a few specific annexes each year to ensure that the entire plan is updated at least every four years.
- If applicable, develop or incorporate a regional HazMat Team Annex into your EOP.
- Develop an Anti-Terrorism Annex into your EOP.
- Develop a local/regional Debris Management Annex into your EOP.
- Develop and maintain pre-scripted requests for additional assistance (from local area public works, regional mutual aid, State resources, etc.) and local declarations of emergency.
- Develop and maintain written duties and responsibilities for EOC staff positions and agency representatives.
- Develop and maintain a list of private non-profit organizations within your local jurisdiction to ensure that these organizations are included in requests for public assistance funds.
- Prepare a submission for nomination as a “Project Impact” Community.

Training Activities may include:

- Staff members attend training courses at the Emergency Management Institute.
- Staff members attend a “field delivered” training course conducted by NHHSEM.
- Staff members attend other local, State, or nationally sponsored training event, which provides skills or knowledge relevant to emergency management.
- Staff members complete one or more FEMA Independent Study Courses.
- Identify and train a pre-identified local damage assessment team.

Drills and Exercises might include:

- Conduct multi-agency EOC Exercise (Tabletop or Functional) and forward an Exercise Evaluation Report, including after action reports, to NHHSEM (external evaluation of

exercises is strongly encouraged). Drills or Exercises might involve any of the following scenarios:
    - Hurricane Exercise
    - Terrorism Exercise
    - Severe Storm Exercise
    - Communications Exercise
    - Mass Causality Exercise involving air, rail, or ship transportation accident
- Participate in multi-State or multi-Jurisdictional Exercise and forward Exercise Report to NHHSEM.
- HazMat Exercise with Regional HazMat Teams
- NHHSEM Communications Exercises
- Observe or evaluate State or local exercise outside your local jurisdiction.
- Assist local agencies and commercial enterprises (nursing homes, dams, prisons, schools, etc.) in developing, executing, and evaluating their exercise.
- Assist local hospitals in developing, executing and evaluating Mass Care, HazMat, Terrorism, and Special Events Exercises.
- Administrative Projects and Activities may include:
- Maintain an Emergency Operations Center (EOC) and alternate EOC capable of accommodating staff to respond to local emergencies.
- Establish and maintain a Call-Down List for EOC staff.
- Establish and maintain Emergency Response/Recovery Resource Lists.
- Develop or Update Emergency Management Mutual Aid Agreements with a focus on Damage Assessment, Debris Removal, and Resource Management.
- Develop and maintain written duties and responsibilities for EOC staff positions and agency representatives.
- Develop or Update Procedures for tracking of disaster-related expenses by local agencies.

FLOOD MITIGATION ASSISTANCE (FMA) PROGRAM - FMA was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FMA regulations can be found in 44 CFR Part 78. Funding for the program is provided through the National Flood Insurance Fund. FMA is funded at $20 million nationally. FMA provides funding to assist States and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program (NFIP).

There are three types of grants available under FMA: Planning, Project, and Technical Assistance Grants. FMA Planning Grants are available to States and communities to prepare Flood Mitigation Plans. NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project Grants. FMA Project Grants are available to States and NFIP participating communities to implement measures to reduce flood losses. Ten percent of the Project Grant is made available to States as a Technical Assistance Grant. These funds may be used by the State to help administer the program. Communities receiving FMA Planning and Project Grants must be participating in the NFIP. A few examples of eligible FMA projects include: the elevation, acquisition, and relocation of NFIP-insured structures.

States are encouraged to prioritize FMA project grant applications that include repetitive loss properties. The FY 2001 FMA emphasis encourages States and communities to address target repetitive loss properties identified in the Agency's Repetitive Loss Strategy. These include structures with four or more losses, and structures with 2 or more losses where cumulative payments have exceeded the property value. State and communities are also encouraged to develop Plans that address the mitigation of these target repetitive loss properties.

APPENDIX C:
SAFFIR/SIMPSON HURRICANE SCALE

Courtesy of National Hurricane Center

This can be used to give an estimate of the potential property damage and flooding expected along the coast with a hurricane.

Category	Definition	Effects
One	Winds 74-95 mph	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal road flooding and minor pier damage
Two	Winds 96-110 mph	Some roofing material, door, and window damage to buildings. Considerable damage to vegetation, mobile homes, and piers. Coastal and low-lying escape routes flood 2-4 hours before arrival of center. Small craft in unprotected anchorages break moorings.
Three	Winds 111-130 mph	Some structural damage to small residences and utility buildings with a minor amount of curtainwall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain continuously lower than 5 feet ASL may be flooded inland 8 miles or more.
Four	Winds 131-155 mph	More extensive curtainwall failures with some complete roof structure failure on small residences. Major erosion of beach. Major damage to lower floors of structures near the shore. Terrain continuously lower than 10 feet ASL may be flooded requiring massive evacuation of residential areas inland as far as 6 miles.
Five	Winds greater than 155 mph	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Major damage to lower floors of all structures located less than 15 feet ASL and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5 to 10 miles of the shoreline may be required.

Above information can be found at: http://www.fema.gov/hazards/hurricanes/saffir.shtm

APPENDIX D:
ENHANCED FUJITA TORNADO DAMAGE SCALE

The Enhanced Fujita Scale			
F-Scale Number	Potential Damage	Wind Speed	Type of Damage
F0	Light	65 – 85 mph	Little to no damage to man-made structures. Breaks branches off trees; pushes over shallow-rooted trees; damages signs
F1	Moderate	86 – 110 mph	Beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; Moderate damage.
F2	Considerable	111 – 135 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars from trains pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe	136 – 165 mph	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cards lifted and thrown.
F4	Devastating	166 – 200 mph	Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	Incredible	Over 200 mph	Strong frame houses leveled off foundations and carried considerable distances; automobile-sized missiles fly through the air in excess of 109 yards; trees debarked; steel reinforced concrete structures badly damaged. Complete devastation.

APPENDIX E:
THE RICHTER MAGNITUDE SCALE

Earthquake Severity

Magnitudes	Earthquake Effects
Less than 3.5	Generally, not felt, but recorded.
3.5-5.4	Often felt, but rarely causes damage.
Under 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0-7.9	Major earthquake. Can cause serious damage over larger areas.
8 or greater	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Information above found at:
http://www.seismo.unr.edu/ftp/pub/louie/class/100/magnitude.html

The Richter Magnitude Scale - Seismic waves are the vibrations from earthquakes that travel through the Earth; they are recorded on instruments called seismographs. Seismographs record a zig-zag trace that shows the varying amplitude of ground oscillations beneath the instrument. Sensitive seismographs, which greatly magnify these ground motions, can detect strong earthquakes from sources anywhere in the world. The time, locations, and magnitude of an earthquake can be determined from the data recorded by seismograph stations.

The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Earthquakes with magnitude of about 2.0 or less are usually call micro earthquakes; they are not commonly felt by people and are generally recorded only on local seismographs. Events with magnitudes of about 4.5 or greater - there are several thousand such shocks annually - are strong enough to be recorded by sensitive seismographs all over the world. Great earthquakes, such as the 1964 Good Friday earthquake in Alaska, have magnitudes of 8.0 or higher. On the average, one earthquake of such size occurs somewhere in the world each year. The Richter Scale has no upper limit. Recently, another scale called the moment magnitude scale has been devised for more precise study of great earthquakes. The Richter Scale is not used to express

damage. An earthquake in a densely populated area which results in many deaths and considerable damage may have the same magnitude as a shock in a remote area that does nothing more than frighten wildlife. Large-magnitude earthquakes that occur beneath the oceans may not even be felt by humans.

Appendix F
Thunderstorm Criteria

Extreme Weather Madness
Thunderstorm Criteria

THUNDERSTORM TYPES	Rainfall Rate/hr	MAX WIND GUST	HAIL SIZE	PEAK TORNADO Possibility	LIGHTNING FREQUENCY (5 min Intervals)	Darkness Factor	STORM IMPACT
T-1 – Weak thunderstorms or Thundershowers	.03-.10	< 25 MPH	None	None	Only a few strikes during the storm.	Slightly Dark. Sunlight may be seen under the storm.	1. No damage. 2. Gusty winds at times.
T-2 – Moderate Thunderstorms.	.10"-.25"	25-40 MPH	None	None	Occasional 1-10	Moderately Dark. Heavy downpours may cause the need for car lights.	1. Heavy downpours. 2. Occasional lightning. 3. Gusty winds. 4. Very little damage. 5. Small tree branches may break 6. Lawn furniture moved around
T-3 – Heavy Thunderstorms 1. Singular or lines of storms.	.25"-.55"	40-57 MPH	1/4 " to ½"	EF0	Occasional to Frequent 10-20	Dark. Car lights used. Visibility low in heavy rains. Cars may pull off the road.	1. Minor Damage. 2. Downpours that produce some flooding on streets. 3. Frequent lightning could cause house fires. 4. Hail occurs within the downpours. 5. Small branches are broken. 6. Shingles are blown off roofs.
T-4 – Intense Thunderstorms 1. Weather supercells 2. Bow Echoes or lines of storms	.55" – 1.25"	58 to 70 MPH	1" to 1.5"	EF0 to EF1	Frequent 20-30	Very Dark. Car lights used. Some street lights come on.	1. Moderate Damage. 2. Heavy rains can cause flooding to streams and creeks. Roadway flooding. 3. Hail can cause dents on cars and cause crop damage. 3. Wind damage to trees and buildings. 4. Tornado damage. 5. Power outages.
T-5 – Extreme Thunderstorms 1. Supercells with family of tornadoes. 2. Derecho Windstorms	1.25" – 4"	Over 70 Mph	Over 1.5" to 4"	EF2 to EF5	Frequent to Continuous. 30	Pitch Black. Street Lights come on. House lights may be used	1. Severe Damage to Trees and Property. Damage is widespread. 2. Flooding rains. 3. Damaging hail. 4. Damaging wind gusts to trees and buildings. 5. Tornadoes EF-EF5 or family of tornadoes can occur. Tornadoes can cause total devastation. 6. Widespread power outages.

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Appendix G
Lightning Risk Definitions

Lightning Risk Definitions	
Low Risk	Thunderstorms are only expected to be isolated or widely scattered in coverage (20 Percent Chance). Atmospheric conditions do not support frequent cloud-to-ground lightning strikes.
Moderate Risk	Thunderstorms are forecast to be scattered in coverage (30-50 Percent Chance). Atmospheric conditions support frequent cloud-to-ground lightning strikes.
High Risk	Thunderstorms are forecast to be numerous or widespread in coverage (60-100 Percent Chance). Atmospheric conditions support continuous and intense cloud-to-ground lightning strikes.

Appendix H

Hail Size Description Chart

Hail Size Description Chart

Hailstone size	Measurement	
	in.	cm.
bb	< 1/4	< 0.64
pea	1/4	0.64
dime	7/10	1.8
penny	3/4	1.9
nickel	7/8	2.2
quarter	1	2.5
half dollar	1 1/4	3.2
golf ball	1 3/4	4.4
billiard ball	2 1/8	5.4
tennis ball	2 1/2	6.4
baseball	2 3/4	7.0
softball	3.8	9.7
Compact disc / DVD	4 3/4	12.1

Note: Hail size refers to the diameter of the hailstone.

Appendix I

Sperry-Pitz Ice Accumulation Index

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	DAMAGE AND IMPACT DESCRIPTIONS
0	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
2	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
3	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
4	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
5	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Appendix J

Wildland Urban Interface (WUI) Exposure Zones – NIST Technical Note 1748, January 2013
Source: National Institute of Standards and Technology (NIST), US Dept. of Commerce

Table 4: E-Scale Building Construction Classes and Attributes

WUI scale	Building Construction Class	Ignition Vulnerabilities from Embers and Fire	Building Construction and Landscaping Attributes for Protection against Embers
E1 or F1	WUI 1	None	Normal Construction Requirements: - Maintained Landscaping - Local AHJ-Approved Access for firefighting equipment
E2 or F2	WUI 2	In this area, highly volatile fuels could be ignited by embers. Weathered, dry combustibles with large surface areas can become targets for ignition fro m embers.	Low Construction Hardening Requirements: - Treated combustibles allowed on structure - Attached treated combustibles allowed - Treated combustibles allowed around structure - Low flammability plants - Irrigated and well maintained Landscaping - Local AHJ-Approved Access for firefighting equipment
E3 or F3	WUI 3	Exposed combustibles are likely to ignite in this area from high ember flux or high heat flux	Intermediate Construction Hardening Requirements: - No exposed combustibles on structure - Combustibles placed well away from structure - Low flammability plants - Irrigated and well maintained landscaping - Local AHJ-Approved Access for firefighting equipment
E4 or F4	WUI 4	Ignition of combustibles from direct flame contact is likely.	High Construction Hardening Requirements: - No exposed combustibles - All vents, opening must be closed - Windows and doors must be covered with insulated non-combustible coverings. - Irrigated and well maintained low flammability landscaping - Local AHJ-Approved Access for firefighting equipment

Appendix K
Board of Selectmen's Agenda for Public Hearing on Draft Plan

AGENDA